

GLOBAL INDEX



KUBOTA CORPORATE
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2011

A Journey of Food, Water, and the Environment

Kubota
For Earth, For Life

◆ Opening Message

The Beginning of a New Journey

A long time ago, several million years ago, in fact, one of our ancestors slowly rose up and began walking upright on two legs. Before long our direct ancestor, *Homo sapiens* (the modern human), was born in Africa.

Humans then left African soil to set out on a harsh yet glorious journey – in quest of a new frontier for their survival.

Human evolution is nothing more than following the trajectory of that journey.

And now, in the 21st century, we have begun to realize that the core state of things is not so very different from when we first set out on our quest.

That is to say that the very survival of humans is now at stake, and we must undertake a journey to ensure our survival...

The memories of evolution are deeply engraved in humanity.

To live is to feel the light and the wind, to breathe, and to take food and water into our bodies to sustain life.

However, our global environment stands on the verge of crisis, and all over the world food and water shortages are worsening at an accelerated pace.

Food, water, and the environment –

Only when we find solutions to the problems associated with these irreplaceable necessities, can we begin to pave the path toward human survival and open up a new frontier.

In the wake of the Great East Japan Earthquake

We at Kubota would like to express our most heartfelt condolences to the victims of the Great East Japan Earthquake, which struck in the afternoon of March 31, 2011. We sincerely wish for the earliest possible recovery of the affected areas. Faced with this unprecedented catastrophe, everyone at Kubota has renewed their determination that it is our mission as a responsible corporate citizen to make continued efforts to minimize the damage from natural disasters by tapping into all of the wisdom that we have.

One of the featured articles in this issue of *GLOBAL INDEX* tells the story of how we developed the earthquake-resistant pipes that underpin our living environment, effectively representing the fruit of our most assiduous efforts to ensure the earthquake resistance in water pipes, one of the most essential utilities of our social livelihood. As in the case of our earthquake-resistant pipes, we at Kubota will remain committed to the creation of a living environment that will protect human lives and lifestyles and the development of social infrastructures.

C O N T E N T S

02	Opening Message	The Beginning of a New Journey
04	Prologue	Planet Earth in the 21 st Century 6.9 Billion Peoples' Journey into the Future In Quest of Solutions to Global Problems Involving Food, Water, and the Environment
07	Chapter 1 [Food]	I The Bountiful Mekong Delta Vietnam catches the wave of mechanized farming 20 Column Unique Food Culture Nurtured by the Mekong River
23	Chapter 2 [Water]	II Reviving Chaohu Lake, a Wellspring of Life Environmentally friendly water circulation project in the vicinity of Hefei in China's Anhui Province
33	Chapter 3 [Environment]	III Milestone in the Fight against Global Warming Chubu Sewage Treatment Center, Hamamatsu City Reducing CO ₂ emissions by converting the fuel of a sewage sludge incinerator 40 Column "100-Year" Durability – Our Benchmark – "GENEX" Next-generation Earthquake-resistant Ductile Iron Pipe
42	Special Interview	Humans Now Have an Urgent Decision and Resolution to Make With a Clear Recognition of the Situation, We Must Make a Paradigm Shift of Values to Protect this Planet from the Catastrophes Resulting from "Global Warming!" Ryoichi Yamamoto Chairman, International Green Purchasing Network (IGPN) Professor Emeritus, University of Tokyo
46	Closing Message	Living on Planet Earth

Cover photo: Mekong River, Vietnam

Planet Earth in the 21st Century 6.9 Billion Peoples' Journey into the Future

In Quest of Solutions to Global Problems Involving
Food, Water, and the Environment

FOOD

A Quantum Leap in Scientific Civilization That Stimulated the Turbulent 20th Century

In 1901 – the dawn of the 20th century – Stockholm, Sweden, saw the first award ceremony of the Nobel Prize, which was established in accordance with the last will of Alfred Nobel, famed for his invention of dynamite. Perhaps the fact that the Nobel Prize, which has honored men and women for their outstanding achievements in the progress of humankind, was born in the very first year of the 20th century was indicative of the course to be followed by what was then a new century, remembered in the history books as a “century of science.” It was the Industrial Revolution extending across the 18th and 19th centuries that paved the way for the dramatic progress in scientific civilization in the 20th century. Triggered by technological innovation, the Industrial Revolution spread throughout the globe and went on to drastically change the framework of social economy by giving birth to capitalist and industrialized societies. World powers then began to engage in a struggle for supremacy over the division of the world as they sought overseas markets in the form of colonies. This eventually led to the two World Wars, which wrought enormous destruction and confusion. The tragic consequences will long be remembered as a deplorable mistake of humankind in the 20th century.

Meanwhile, the scientific civilization of the 20th century achieved remarkable progress. From spacecraft, aircraft,

and ships, to automobiles and high-speed railways, significant advances in the means of transportation have dramatically expanded the range of human activities into the sky, the ocean, and outer space. Scientific civilization has also continued to spawn epoch-making technologies and products in diverse fields. The establishment of polymer chemistry accelerated chemical synthesis, and this technology was applied not only to synthetic fibers and drug discovery, but to the manufacturing of various industrial products as well. In the medical and biological fields, advances in gene engineering and biotechnology, which involve DNA and genomes, helped to overcome illnesses and prolong lives. The advent of computers has also had the most decisive impact on society since the Industrial Revolution of the 18th century, while the invention of integrated circuits and development of information engineering and communication technologies have written a new page in the progress of human society. It is safe to say that 20th century humanity truly enjoyed the benefits of such scientific civilization in the constant pursuit of greater affluence. At one time this attempt seemed to promise us a bright future, but in the latter half of the 20th century we found ourselves facing new and difficult problems.

Planet Earth and Humanity in a State of Crisis What We Need is a “Path toward Survival”

Progress in scientific civilization has prompted industrial

advancement in developed countries, followed by the birth of a society based on “mass production and mass consumption” as a symbol of affluence. To realize affluence, economic growth was required. This economic growth, pursued not only by developed countries but by developing countries as well, resulted in the mass consumption of fossil fuels. It is a matter of common knowledge that such all-out usage of fossil fuels has invited a rapid increase in the emissions of CO₂ and other greenhouse gases, and it is no exaggeration to say that the serious environmental issues brought about by resultant warming of the globe are the most urgent problems that humankind must solve. The impact of global warming is already becoming evident in many areas – rising atmospheric and oceanic temperatures, sea level changes, floods and draughts, abnormal weather such as intense heat and hurricanes, extinction of species, as well as depletion of water resources, accelerated desertification and loss of forests, and decreased food resources as a result of their effects on farming and fishery. As such, global warming can have a serious impact not only on weather and the natural environment, but also across an even broader range of fields that are tied up in those issues, including our society, economy, and livelihood.

Closely intertwined with these environmental problems brought about by global warming are food and water issues. Standing at around 2.5 billion in the early 20th century, the global population exceeded the 6.0 billion

mark within this century (now 6.9 billion). It is expected to continue to increase to 7.7 billion by 2020 and 9.2 billion by 2050, giving rise to the concern that serious food shortages will occur on a global scale. As if linked with the population explosion, shortages of water – a necessity for human survival – are becoming increasingly serious in many parts of the world. Only 0.01% of the Earth's water may be consumed by humans, and it is estimated that 1.1 billion people around the world do not have access to safe water, while 2.4 billion live without sewerage and other sanitation facilities. Given the population growth expected in the future, it is clear that this serious shortage of water on a global scale demands an urgent response. We must realize that humanity may collapse if we cannot put an end to these unprecedented critical changes that are affecting the entire globe.

In sharp contrast to the 20th century, which must have begun with brilliant hopes and dreams for the future, the 21st century opened with anxiety and fear caused by the terrorist attacks of September 11, 2001 in the United States. As if this event had indicated what was to lie ahead, the 21st century has been ridden with an accumulation of difficult problems. These include not only global environment issues, but also conflicts between religions and races, terrorism, the existence of nuclear weapons capable of annihilating the human race several times, incurable infectious diseases, and the gap between rich and poor countries as exemplified by the North-South divide. Under such circumstances, we as humans are now





required to seek a “path toward survival” by uniting our wisdom and keeping the strong will to survive on this Planet Earth. We should never let this journey of 6.9 billion people into the future come to an end.

In the 21st Century, Kubota Will Tackle Global Problems in the Areas of Food, Water, and the Environment

Having celebrated the 120th anniversary of its foundation in April 2010, Kubota has promoted its corporate activities amid global upheavals across three centuries, from the 19th to the 21st century. Throughout its history, Kubota has set for itself the mission of taking on the challenge of “resolving social problems” through its business undertakings. Lamenting over the many lives being lost due to waterborne infectious maladies such as cholera in the late 19th century, Kubota founder Gonshiro Kubota keenly felt the need to develop waterworks for controlling such diseases, thus beginning Japan’s first production of iron pipes for water supply in 1893. Since that time, the company has leveraged the multifaceted products and technology in its business to offer solutions required by society to problems such as national modernization and development of social infrastructures during the Meiji period (1868-1912), post-war reconstruction, high economic growth, and subsequent environmental issues. “Promotion of corporate activities directly contributes to the betterment of society” – this philosophy sums up

Kubota’s “DNA” that has taken root and been continuously inherited throughout the company’s history. On the occasion of its 120th anniversary, Kubota established the corporate mission of “solving the worldwide problems of food, water, and the environment.” In the area of food, the company will help to resolve the world’s food problems through the supply of tractors, combine harvesters, and other forms of farming machinery and agricultural management techniques developed based on its experience with paddy field agriculture. Water supply is the most important infrastructure for humans as it is directly connected to food and environmental problems. Tapping into its total “water engineering” prowess nurtured through business in Japan, Kubota aims to offer solutions to the world’s water problems. And in the area of the environment, the company will make the most of its “environmental engineering,” which has been uniquely developed from its waterworks business, in order to share innovations in environmental conservation with the rest of the world.

This issue of GLOBAL INDEX coincides with the new mission that Kubota has embraced. Each topic covered here clearly reflects Kubota’s DNA. Continuing the will that has been built into that DNA and taking action accordingly will serve as a strong support for the sustainable development of the world and humanity, and eventually contribute to a “better tomorrow for the Planet Earth” – This is Kubota’s firm conviction.

The Bountiful Mekong Delta

Vietnam catches the wave of mechanized farming

In the vast stretch of mountainous areas extending across the Tibet Autonomous Region at the eastern tip of the Himalayas, China’s Yunnan province, and northeastern Myanmar, a number of deep gorges are carved into the landscape. Fed from the waters of these regions and passing through a total of six countries including Laos, Thailand, and Cambodia to eventually reach southern Vietnam is the Mekong River – Southeast Asia’s longest river with a total length in excess of 4,800 km. Vast amounts of soil washed down from erosion in the upper reaches of the river have accumulated through powerful sedimentation to form an extensive delta in the downstream areas of the Mekong River. In Vietnam alone the delta area covers an extensive area of some 40,000 km² (4 million ha), making it by far the country’s largest breadbasket. In September 2008, Kubota became the first international agricultural machinery manufacturer to establish a subsidiary in the Socialist Republic of Vietnam (Kubota Vietnam Co., Ltd. [KVC]) in order to explore the Vietnamese market with a focus on the Mekong Delta region. In this feature article, we zoom in on the circumstances faced by Vietnamese rice farmers amid the wave of mechanized agriculture with updates on Kubota’s activities there, along with a brief introduction to the Vietnamese food culture nurtured by the fertile land of the Mekong Delta. Our journey begins in Ho Chi Minh City, the country’s largest metropolis and gateway to the Mekong Delta.



■ Socialist Republic of Vietnam

Creating a Dealer Network in the Mekong Delta Region while Cultivating a Service-oriented Mindset

Ho Chi Minh City. French Colonial architecture, an opera house standing at the city center, a Catholic church – scattered throughout the city one can still see the lingering vestiges of the French colonial rule. At the same time, this is a city that has followed, and still follows, an explosive growth trajectory, propelled by the socialist-oriented market economy introduced following the Doi Moi (renovation) economic reforms initiated in 1986. Not surprisingly, nothing among the buildings recalls the days of the Fall of Saigon in 1975, which marked the end of the Vietnam War, and the southern tranquility that was so visible in the past – women clothed in *ao dai* and families on motorcycle excursions

in the cool of the evening – is most certainly being lost. Heavy foreign capital inflow stemming from a desperate effort to accelerate the transition to a market economy has completely altered the face of the city. High-rise buildings, elegant condominiums, shopping malls, name-brand stores, restaurant chains, electronics mass merchandisers, and so forth – the scenery here is not so different from what would be seen in Japan or advanced countries of the West. However, this familiar scenery is broken up by the presence of a tremendous number of speeding motorcycles. During the morning and evening rush hours, the streets are flooded with an overwhelming tide of two-wheeled vehicles that completely cover the roads. It is as if the motorcycles themselves represent the driving force behind the economic growth of Vietnam, one of Asia’s most up and coming countries.

Saigon Notre-Dame Basilica constructed in the late 19th century (Church of the Holy Mother)



Flowing through the city center, the Saigon River plays a key role in the city’s water transport system.



Waves of commuter motorcycles flood the morning streets in Ho Chi Minh City.



The Ben Thanh Roundabout is the key road junction leading to central and northern Vietnam.



Ho Chi Minh >

Skyscrapers rise up in Ho Chi Minh City



The Central Post Office with a magnificent classical arched ceiling



With a skilled driver behind the wheel, our 10-seat van maneuvers through the waves of motorcycles to KVC, Kubota’s outpost in the Vietnamese market located in the My Phuoc Industrial Park, 45 km north of Ho Chi Minh City. Some 70% of Vietnam’s citizens live in rural areas, and agricultural and marine products account for roughly 30% of the country’s exports; however, the rate of mechanization in the farming sector stands at only around 20%. Several years ago, Kubota began a market survey in the country and concluded that Vietnam, and particularly the Mekong Delta region, was standing on the “eve of mechanization.” It thus went on to establish KVC in September 2008 to produce tractors, combine harvesters, and agricultural implements. The country requires agricultural machinery, primarily due to the current labor shortage as ongoing industrialization leads the workforce to concentrate in metropolitan areas, and also because of the essential need to increase crop yields efficiently. Given this situation, KVC began its inroads into the market by creating a dealer network in and around the Mekong Delta. As of now, the network has expanded to cover nearly the entire delta area.

“Our goal is to be the leading manufacturer of a comprehensive range of agricultural machinery in Vietnam. The key to achieving our aim is to have an extensive dealer network and offer better customer service at each contact point. This is where we are pouring in the greatest amount of resources. One of the things that we are doing in this regard is helping local dealer staff to develop a ‘business mindset,’ e.g., providing training sessions and other occasions to teach them what it means to serve others. When leading players from Europe and North America and Japanese competitors enter the Vietnamese market in the future, I believe that quality of service will be the single most important factor in making positive differentiation. By fostering a service-oriented mindset in each individual staff member at our dealers, we can propose solutions that cater to specific user demands – This is something that we are eagerly engaged in at this time.” (Satoshi Suzuki, General Director, KVC)

Right: Unhulled indica rice (polished)
Indica makes up the majority of rice produced in Vietnam.

Left: Portraits of Ho Chi Minh, symbol of the country's unification, are still found everywhere in the country.



Winding Road for Farming in Vietnam Surging Rice Production in the Mekong Delta

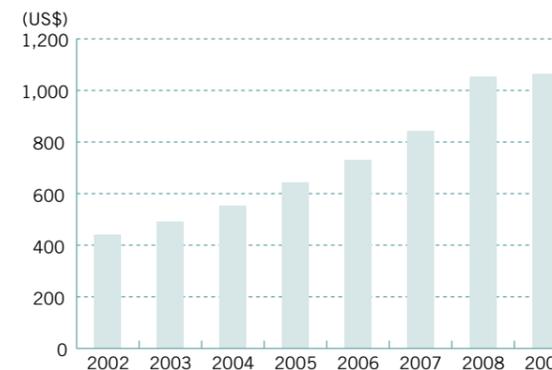
In its 2001-2010 Strategy for Socio-Economic Development ^{*1}, the Vietnamese Government set forth that it would accelerate industrialization and modernization of the country in order to become a full-fledged industrial country by 2020. Since 2000, their GDP CAGR has been over 7%, and GDP per capita topped US\$1,000 in 2008. This rapid economic growth has had no small impact on rice farming. Before going into the details of the present situation, let us take some time to look back at the modern history of agriculture in Vietnam, which has undergone considerable vicissitudes as it was tossed about by the country's political regime. When the country was divided between the north and south, farmers in North Vietnam formed "cooperatives" for collective farming, whereas their counterparts in South Vietnam followed a landholding system. After the country was unified, collectivization of agriculture was promoted rather abruptly in an effort to establish a socialist country, but agricultural output dropped significantly due to inefficient production and a decline in motivation on the part of producers, with the result that it became necessary to import rice. Faced with a serious food shortage, the Vietnamese Government made an about-face in its agricultural policy: rather than trying to collectivize farmers into cooperatives, they encouraged family operations and allowed them to trade surplus products freely at market price. As a result, Vietnam's agricultural production increased tremendously to make it the world's third largest rice exporting country in 1989, but this was not the end of their reforms. With the revision of the Land Law in 1993, households or individuals were entitled to

exchange, transfer, lease, inherit, and mortgage land use rights. This virtually authorized the privatization of land, which was still supposed to be held by the State, if only in name. The country went on in 1996 to become the world's second largest rice producer after Thailand, a position it still holds to this day.

The driving force behind all of these developments was the Mekong Delta, which recorded during the same period a large and rapid increase in rice production unparalleled in the history of Asia. According to the General Statistics Office of Vietnam, rice production in the Mekong Delta region stood at 12.83 million tons in 1995, which then grew to become 16.70 million tons five years later in 2000. In 2009, of the 38.90 million tons of rice produced in Vietnam (the fifth largest volume in the world), 20.48 million tons, or 52%, was produced in the Mekong Delta region. Such a surge in production is partially attributable to the Vietnamese Government's policy for increased rice production. By casting the Mekong Delta as a strategic export rice production center, they focused their investments in the development of irrigation and drainage systems in that region. The result was an increase in the area of paddy fields and in crop acreage due to double and triple cropping. Other factors contributing to the phenomenal increase in rice production included the diffusion of new rice varieties with high yield, greater use of fertilizers and other production materials, and the introduction of tractors and other agricultural machinery.

***1 2001-2010 Strategy for Socio-Economic Development**
National development planning announced by the Vietnamese Government. With the goal of leaving behind its status as a low-income country (by 2010) to become an industrialized country (by 2020), the government plans to accelerate industrialization and modernization along the socialist line, while laying the foundations to become an advanced industrialized country by 2020.

GDP per capita in Vietnam



Source: General Statistics Office of Vietnam, 2009

Region-specific rice acreage/production in Vietnam

	Acreage (10,000 ha)	% to total acreage	Production (1,000 t)
Whole country	744.0		38,895.5
Red River Delta	115.5	16%	6,796.3
Northern Midlands and Mountain Areas	66.9	9%	3,047.1
North Central and Central Coastal Areas	122.2	16%	6,252.0
Central Highlands	21.4	3%	994.3
South East Area	30.7	4%	1,322.4
Mekong River Delta	387.3	52%	20,483.4

General Statistics Office of Vietnam, 2009

On the shop floor, an experienced engineer from Japan provides technical guidance to young engineers from dealers.



General Manager Yutaka Iwasaki (left) and Factory Manager Nguyen Tho Thinh (right). Kubota's rigorous quality control has been fully inherited by KVC.

Kubota Vietnam Co., Ltd.(KVC)



Satoshi Suzuki, General Director, KVC

Let us take a look at Kubota's sales in 2009 and 2010. Unit sales of new tractors and combine harvesters together quintupled between 2009 and 2010. The Vietnamese tractor market once topped the 10,000 unit mark annually, but most of these are used tractors made by Kubota or others imported from Japan, putting us in a rather distressing situation where we are forced to compete against used tractors of our own making in the market. Combine harvesters, on the other hand, are showing remarkable growth. Several years ago, combine harvesters made by Chinese manufacturers hit the Vietnamese market, but were not necessarily well-accepted by local farmers due to the high loss rate (percentage of grains not harvested due to falling during mowing, etc. to total grains) and frequent breakdowns.

In Vietnam, combine harvesters are evaluated in terms of loss rate and durability, because smaller loss equates to higher income. It is estimated that the loss rate of Kubota's combine harvesters is less than half that of its Chinese competitors. Also, durability is crucial in Vietnam, where the annual operating time of combine harvesters is said to be several times greater than that of rice farmers in Japan, as double and triple cropping is common (Another major reason for this is that many users of combine harvesters are "harvesting services." We will return to this later). All in all, it was Kubota's high reputation for performance and quality relative to competing models of Chinese manufacturers that helped to boost our sales volume.



Canals such as this one form an extensive network stretching over the vast grain belt.

I Chapter 1 [Food] The Bountiful Mekong Delta

cropping then spread extensively, driving up rice production. However, there was no way that the paddy fields could be used during the “flood season,” which typically lasts up to four months. As such, the Vietnamese would divide the remaining eight months of the year into two periods, growing and harvesting crops within those four month timeframes. Following Doi Moi, however, triple cropping began to expand in the Mekong Delta region. This was made possible by greater zeal for production among the increasing number of independent farmers, and the construction of “banks” designed to prevent inundation during the flood season. By surrounding the entire farmland of the region with anti-flood dikes, it was made possible to cultivate rice even during the flood season.

The scenery of the Mekong Delta reminds us of a grain belt in Japan, but one thing is markedly different between the two. Because rice is grown through double and triple cropping, each area represents a different

stage of rice farming – in one paddy field the rice ears are all out, another field is covered with water like a lake, and in yet another field seeds are being sown (In the Mekong Delta, direct sowing, rather than planting cultivated seedlings, is preferred.). Another intriguing factor is the presence of Chinese-style temples, shrines, and graves in the middle of paddy fields. Our local guide Mr. Nguyen Hong Hap explains that they are there for “farming rice under the protection of the ancestors.” Given the fact that bodies are typically interred in the soil in Vietnam, we cannot help but recall the continuing circle of life and death – once the soul is lost, the body returns to the earth, where a crop of rice then grows. For people living in the Mekong Delta, rice truly is “life” itself.

Dong Thap >

Outside of Ho Chi Minh City, female students in *ao dai* are seen more frequently.



Dry and Rainy Seasons in the Tropical Mekong Delta Floodwaters Produce Bountiful Soil

Driving south from Ho Chi Minh City, our van heads to Dong Thap Province, one of the 12 provinces in the Mekong Delta region. As we enter the Mekong Delta, urban landscapes such as those in Ho Chi Minh City vanish and an immense grain belt spreads before our eyes. Located in the tropics, the Mekong Delta does not have seasonal changes, and instead has only a rainy season (May to October) and dry season (November to April) due to the influence of tropical monsoons. Temperatures remain high throughout the year (around 30 degrees centigrade) and the amount of solar radiation is very high. What makes the delta region so unique is that its lowlands turn into a floodplain during

the rainy season, with water levels reaching a depth of several meters. With the entire area of villages submerged, all that can be seen when this flood occurs are houses built on high ground scattered throughout like so many small islands. But this is not a “flood” as we think of it – no flash floods sweep the farmland away, but rather the water level rises gradually to deeply submerge the area for some time until the water begin to recede with the arrival of the dry season. It is nature’s providence – in this case, the Mekong River – that has provided the vegetation with the nutrients required to grow, thus cultivating fertile soil that is suitable for rice farming. It was not until relatively recently that the development of the Mekong Delta, a frontier that promises vast spreads of land, went into full swing during the French colonial period between the 19th and 20th centuries. After the end of the Vietnam War, double



Paddies that could be mistaken for lakes stretch as far as the eye can see.

Temples/shrines and graves dotted amongst paddy fields form the typical landscape of the Mekong Delta.

A Top Dealer Leading the Way in Expanding Sales “Cultivating/Harvesting” Services for Farmers

Dong Thap Province – bordering Cambodia in the north, this district was liberated during the Vietnam War. Reclaimed by farmers escaping the war and the soldiers of liberation forces, this fertile grain belt spans over approximately 450,000 ha with 70% of its farmers engaged in double cropping and 30% in triple cropping. Our destination is “Tan Hai,” a top achiever in KVC’s extensive network of dealers. General Director Ngo Tan Hai formerly dealt in Chinese combine harvesters. Immediately after Kubota established a Vietnamese subsidiary, he opted to be Kubota’s exclusive dealer without hesitation. The reasons for his decision were clear. He had become fed up with countless complaints from users about China-made machines breaking down and heard from people about the high quality of Kubota’s combine harvesters. So, what marketing

strategy is he pursuing to boost his performance as a dealer?

“Kubota is known for its quality machines, and their products diffuse and spread on their own through referrals from users and word of mouth. Unit sales of Kubota’s combine harvesters grew in 2009 and 2010, and we expect to sell even more in 2011. Our biggest sales event is demonstrations. We send out invitations to owners of Chinese combine harvesters and potential users, and we have about 200 to 300 guests attend each event. Providing demonstrations is definitely a major opportunity to boost sales.”

However, the price tag of a Kubota combine harvester far exceeds that of any China-made machine. While it is true that the country is undergoing rapid economic growth, this begs the question of whether people in Vietnam, where per capita GDP is estimated at US\$1,100, can actually afford to pay for high-end

combine harvesters from Kubota. Here are some facts from the General Statistics Office of Vietnam: the average monthly income per capita in the Mekong Delta region was 940,000 dong (approximately US\$ 45*) with in the figure for urban districts being 1.6 million dong (approximately US\$ 77*; however, it should be noted that the income of the Vietnamese continues to grow every year, and the current level of income in urban districts may be expected to be higher than this. Incidentally, the average monthly income of workers at government enterprises was 2,917,000 dong, or approximately US\$ 141, in the first half of 2010.). Following the introduction of Doi Moi, Ho Chi Minh and other large cities have been making spectacular progress, while living standards in farming villages remain low. In addition to low rice prices, a structural issue also plays a role here: intensive rice farming (multiple cropping, etc.) in the Mekong Delta incurs high expenditures, thereby resulting in a lower net income ratio. Supply from the used market ensures access to various types of inexpensive yet high-quality agricultural machines, but like other countries in Southeast Asia it is indeed a luxury undreamt of by ordinary farmers in Vietnam to purchase brand new machines by themselves, considering their income level. It is beyond the bounds of possibility that they would have enough funds to purchase a new combine harvester.

often found not only in Vietnam, but in other parts of Asia such as Thailand and China as well. As the name implies, these services cultivate land and harvest crops for a fee. Such services are not a new creation, but rather an old form of agricultural management created through cooperation within farming village collectives, when such tasks were carried out manually. Many customers of Tan Hai are cultivating/harvesting services, and a large number of them engage in cultivating and harvesting services while growing rice for themselves. According to Tan Hai, their typical profile is that of “affluent farmers engaged in large-scale rice farming.” The area of farmland owned by such farmers usually ranges between 20 ha and 100 ha, and 20% of them own over 100 ha of farmland. If it is taken into account that the average area of farmland owned by one farmer is about 2 ha in the Mekong Delta region, we come to realize that the ongoing mechanization of the region is driven by a handful of rich farmers who also engage in cultivating/harvesting services. While strongly retaining aspects of cooperation within farming village collectives from the past, mechanized cultivating/harvesting services are introducing a modern farming business model to the region. It is this business model that creates a golden opportunity for cultivating/harvesting services to further boost revenues and make quantum leaps forward in their living standards.

Thus, attention should be turned to the contract business of “cultivating/harvesting” services, which are

* Calculated at an exchange rate of 1 dong to US\$ 0.00005, current as of March 2011



Used farming machine dealer. Showing signs of age, the Kubota tractors are still actively used in Vietnam.



Ngo Tan Hai, General Director, Tan Hai

A combine harvester used for demonstrations bears the “Tan Hai” logotype.



Tan Hai, the top dealer in the Mekong Delta

Employees of Tan Hai and their customers (the General Director’s wife can be seen at center)



**“Investing” in Combine Harvesters
High Hopes of Harvesting Service Providers
in the Mekong Delta**

It was only a few years ago when the mechanization of manual harvesting services went into full swing following the arrival of Chinese combine harvesters on the market. (Cultivating services using tractors are also offered, but this report focuses on harvesting services as combine harvesters are the most sought-after agricultural machines in the Mekong Delta.) Driving the wave of farm mechanization in the area, the business of harvesting services is at the center of what could be described as kind of “fever.” We interviewed Mr. Ngo Phuoc Dong (40), a harvesting service provider, who owns 20 ha of farmland.

“I used China-made combine harvesters for harvesting services in the past, but switched to Kubota machines because of their high performance. They generate little loss and do not break down easily. Aside from the hefty price tag they are perfect machines. I own several Kubota combine harvesters, but I would like some more.”

Mr. Dong receives payment to harvest about 1,000 ha of farmland each year, which requires him to run his combine harvesters for several hundred hours annually (making it little wonder that they seek greater durability from combine harvesters than farmers in Japan). After

the payment of expenses, which include wages for miscellaneous work during harvesting, he makes a net profit of several hundred million dong per year. He also sells rice grown on his own farmland. Although he runs his business with the help of his family (six people, including himself), his income level is much higher than that of ordinary farmers in the Mekong Delta. And yet, combine harvesters are not necessarily a “horn of plenty.” The principle of competition also comes into play among harvesting services. Mr. Dong says that he has been able to see order growth by catering to the specific demands of his customer farmers, e.g., lowering the loss rate and finishing the job more quickly.

Mr. Nguyen Van Toi (38) is another harvesting service provider who personally owns 70 ha of farmland. Every day of the year, he works from 7 a.m. to 1 a.m. He has enough jobs to fill up his calendar throughout the year because he works through triple cropping and travels around the Mekong Delta region with his harvesting service. To reach his customers, he transports his combine harvesters on a boat via the crisscrossing network of waterways and canals that covers the delta area. While appreciating the merits of Kubota machines, he has no small number of demands.

“I want machines with greater horsepower and lighter weight. I also want my dealer to respond to my inquiries more quickly, since I would like to work more and improve the quality of my work. I don’t care if I work

Over 200 farmers gather at Tan Hai’s demonstration



Farmers line up beyond the field, waiting to see the combine harvesters and tractors in action



365 days a year. I want to increase my farmland to even double its size in the near future.”

These men certainly belong to the high income bracket in the Dong Thap Province, but it is not likely that they find Kubota-branded combine harvesters inexpensive. Nevertheless, they can afford several units because they consider the harvesting service business a good “investment.” Taking note of the steady cash flow generated by combine harvesters, financial institutions are willing to extend loans. Farmers then use such funds to begin harvesting services and recoup their investments over a short period to purchase a second machine. It is in this investment cycle that Kubota’s combine harvesters, despite their high price tags, are becoming widely used, and the market is expanding. In other words, one of the tools of a market economy, i.e., investment, serves as an engine to propel agricultural mechanization forward in the Mekong Delta region.

Our next stop brings us to the site of a demonstration, which, according to Mr. Tan Hai, is a “major opportunity to boost sales.” Despite the intense sunlight, more than 200 people gather to attentively watch combine harvesters and tractors in action. After many interviews,

we find that they all share a sincere desire to leave behind the “hardships of rice farming” and achieve the affluent lifestyle that harvesting services might bring about. This “ardent expectation for the harvesting business” on the part of farmers is certainly one of the reasons why Kubota concluded that the Mekong Delta was on the “eve of mechanization.” The hard fact is, however, that the majority of farmhouses have nothing to do with this fever for mechanization. On the other hand, there are not a few cases of minorities being hired as time-limited wage labor (Vietnam is a multiethnic country). Looking at things from a different angle, one begins to see a complicated structure of farming business in the region, which defies the simple stereotype of income disparities between the haves and have-nots. Between the shortage of labor that is worsening as the country becomes increasingly urban and industrialized and the government’s request to ramp up rice production, mechanization in the Mekong Delta will only be accelerated. But what will be the outcome? The socialist-oriented market economy that this country has so eagerly pushed forward since the inception of Doi Moi is beginning to dramatically alter the internal landscape of farming villages in the Mekong Delta.

Mr. Ngo Phuoc Dong (left) and Mr. Nguyen Van Toi (right)



Transporting a combine harvester on a boat to a cultivated field – A common sight in the Mekong Delta



Mr. Nguyen Van Tan engaged in farming in Dong Thap Province



“Thanks to the low loss rate of Kubota’s combine harvesters, I have had a greater number of orders for my harvesting service, which greatly improved my livelihood. I hope to do more harvesting service jobs in the future.”



Some scholars even indicate that they have already reached the limit of their land productivity improvement. Will the Mekong Delta continue to bring forth a sustainable bounty? Also, higher rice prices do not necessarily increase the level of farmers' income, with the exception of a few wealthy farmers. To make up for such low income, an increasing number of farmers are taking up wage labor as a side business. Furthermore, as the country becomes increasingly industrial and urbanized and access to information is facilitated, people, especially young people, are pouring into urban districts in the pursuit of affluence. The declining farming population can impoverish farming villages, and

even now the disparities between urban and rural areas are continuing to widen. For the Mekong Delta to remain truly bountiful, it would be necessary to search for a new approach. Revival of the Mekong Delta – this is truly an urgent issue that must be addressed.

Crossing a large suspension bridge in My Tho, one of the major cities in the Mekong Delta region, we are afforded a sweeping view of the boundless expanses of cloudy brown waters making up the Mekong River. Clouds float in the blue sky and, as if stretching on into the very sky itself, the Mekong River flows wordlessly and quietly ever onward.

Mekong Delta >

Mission: Revive the Mekong Delta Working to Sustain Bumper Crops

In contrast to Japan's aging population and declining birthrate, Vietnam's population is exploding by more than one million people each year, and is expected to top 100 million by 2020 (86.02 million in 2009). As such, the necessity of raising rice output stands as a major policy issue for meeting domestic demands. It was this emphasis on maintaining the supply of rice – the country's staple food – that led the Vietnamese government in 2007 to establish quotas on its rice exports (These quotas were later abolished in 2009 due to strong opposition from exporters.). The export restrictions by Vietnam, the world's second largest rice exporting country after Thailand, resulted in a tighter supply in the global rice market and higher international

prices, and were considered to be one of the causes of the global food crisis at that time. In other words, Vietnam's rice policy wields significant influence over the world's food situation. After the global food crisis, Vietnam successfully increased its rice production and exports, but there is no guarantee that this will continue forever. The true concern, however, is whether or not the present rice farming cycle is truly sustainable. In areas where triple cropping is widespread, there is not much time for paddy fields and waterways to dry up even during the dry season. Aside from some drainage, the water within the banks remains largely unchanged and stays in the reservoir indefinitely. Furthermore fertilizers are applied intensively and a large quantity of agricultural chemicals are used. In addition to the deteriorating water quality, the ground has grown sterile and soil quality has become vastly degraded as a result of thorough exploitation of the land via triple cropping.



Unique Food Culture Nurtured by the Mekong River

Food culture is an integral part of ethnicity. Closely involved in every aspect of an ethnic group's lifestyle, including social and economic aspects, beliefs, as well as daily life, food culture determines what makes up a particular ethnicity. In this section, we will examine the food culture of Vietnam with a focus on the Mekong Delta region in order to draw closer to the people's spiritual foundation (Since Vietnam is a multiethnic country, a "Vietnamese race" as such does not exist.). Because of the nation's historical background, in which Chinese influence existed from ancient times, Vietnamese cuisine is strongly influenced by Chinese food. There is also the presence of France's culinary culture, as the country was once under French colonial rule. This artful mixture of two of the world's best cuisines has given birth to an original food culture unique to Vietnam.

Indica rice for making noodles



Hu tieu, a local specialty of My Tho in the Mekong Delta



Fresh vegetables of various colors displayed for sale at a market in My Tho



Food Vietnam >



Culinary Variations of Rice and "Nuoc Mam" Born of the Combination of "Rice and Fish"

Like Japan, people in Vietnam live primarily on a diet of rice. However, what rice means to them is very different from what the Japanese think about this staple food. It is not merely their principal diet; figuratively speaking, it might be more appropriate to say that the "flesh and blood of Vietnamese people is made from rice." For the Vietnamese, rice is deeply ingrained into their culinary lifestyle. For instance, according to statistics compiled by the United Nations Food and Agriculture Organization (FAO), some 60% of the calories they burn come from rice, which is 2.7 times higher than that of the Japanese. Both nations are supposed to live on rice, but rice intake is remarkably different between the two. As in Japan, people in Vietnam consume boiled rice, but they also cook in many different ways. One such rice dish also popular in Japan is *pho* rice noodle soup. Originating in the northern capital of Hanoi, *pho* noodles are usually eaten fresh. Its southern equivalent is *hu tieu*, which is one of the most popular rice noodles in the Mekong Delta region. The key point of difference from *pho* is that it is semi-dried, not fresh, which gives it a unique body that *pho* lacks. Its soup is lightly seasoned, but much sweeter than *pho* regardless of the restaurant it is found in. *Hu tieu* is often served in a bowl with

chicken, pork, and shrimp, and topped with herbs. Before eating, chili pepper and lime are used to season the flavor of the soup. Rice paper is another rice-based foodstuff that is a hallmark of Vietnam. The spring roll is one of the popular Vietnamese dishes to use rice paper in Japan, but in reality it is not consumed so often in Vietnam. The most popular way of enjoying rice paper is by using it to roll meat or fish together with herbs.

Also representing Vietnam's food culture along with rice is *nuoc mam*, a salty fish sauce with a distinctive scent. "Mam" refers to fermented fish or shrimp preserved with salt, and the supernatant fluid skimmed from the well-fermented ingredients is *nuoc mam*, which is used as a seasoning. The birth of *nuoc mam* is related to rice farming. Since paddies' water is taken from a river, they contain many fish. When the harvesting season arrives, the water is drained, which makes it possible to catch a great number of fish, so the technique of pickling them with salt for preservation (fermentation) has been developed. A variety of fish make their way into the paddy fields when they are covered with water during the rainy season, thus bringing about a great variety of fermented foods, and it is believed that these led to the invention of *nuoc mam* (*nuoc mam* as it is known today is the supernatant fluid derived from small fish [a type of sardine] salted for fermentation). It seems that "rice and fish" is truly an inseparable culinary combination.



Legacies of the French Colonial Period – Food Culture and Perfecting the "Balance" of Flavor

One cannot discuss Vietnam's food culture without mentioning the culinary influence of France, its former suzerain state. However, this does not mean that French cuisine had a direct impact on Vietnamese cuisine. Rather, like a parting gift the French left behind their customs of eating French baguettes and drinking coffee. Often sold at street stalls are "*banh mi*," or a type of sandwich made with a baguette. Fillings include sausage, ham, herbs, and vegetables pickled with sweetened vinegar. The savory coffee of Vietnam – proudly the world's second largest coffee bean producer after Brazil – is never perfect without condensed milk. Their coffee is served in cups that contain a generous portion of condensed milk at the bottom, onto which the coffee is then poured. Mixing the condensed milk and the coffee naturally makes a very sweet drink. On the subject of beverages, liquor is also an indispensable and essential part of any culinary culture. As might be expected, the alcoholic beverage enjoyed by farmers of the Mekong Delta region after a hard day's work is closely linked to "rice." Known as "rice spirit" or "rice vodka," it is a strong liquor with around 40% alcohol created by fermenting and distilling rice.

Let us now take a look at Vietnamese restaurants. Upon being

seated, one may be surprised by the many small plates of seasoning that are brought to the table even before the first dish is served: Vietnamese soy sauce, *nuoc mam*, chili sauce, *tuong* (bean sauce), salt and pepper, lime, *yang* (dressing made by mixing vinegar and oil), and sliced red peppers. The table is crowded with small plates containing all of these ingredients. Vietnamese dishes are basically mild in flavor, but what makes the cuisine unique is the way that those dining add seasonings to their own preferred taste. And the way that the Vietnamese eat is no less unique. Plates are not used for individual servings, and instead pieces from particular dishes flavored with a favorite seasoning are placed like toppings in a bowl full of rice and eaten from there. After the toppings are gone, the rice that has absorbed flavor from the various foods is enjoyed. When only a small amount of rice is left, the diner finishes the meal by pouring soup into the bowl and washing the rice down with it. As the rice, toppings, and soup are blended together to create a harmonious combination, an exquisite balance of flavor is achieved. People in different regions prefer different balances. People in the south – home of the Mekong Delta – prefer extremely sweet flavors. It is no surprise then that dishes from the Mekong Delta region are sweet and heavily seasoned. The author noticed their strong preference for sweet flavors when ordering a coke at a general shop in a Mekong Delta farming village. The glass served with the bottle was filled with ice that had been dusted with plenty of sugar.



Hu tieu noodle-making factory. Semi-dried rice paper is machine-cut into noodles.



Made from glutinous rice, Vietnamese distilled liquor is a spirit with 30-45% alcohol.



Abundant catches from the Mekong River are also dried for sale.



Strong coffee is poured into a cup containing plenty of condensed milk.

I Unique Food Culture Nurtured by the Mekong River

**The Chain of People, Rice, Pork, and Water Spinach
Reverence toward the Mekong River's Bounties**

Vietnam has been bestowed with an abundance of livestock, seafood, and vegetables, which are prepared using many different culinary methods. It is not necessary to visit a restaurant to discover a rich variety of tasty dishes; simply take a stroll around the local market and street stalls. Without going into too much detail – after all, this is not a guide to Vietnamese cuisine – the cooking of ordinary families in the country will be briefly mentioned. Perhaps *pho* and spring rolls are the two Vietnamese dishes most popular outside of the country, but neither of them is served in the home. *Pho* is usually eaten at a food stall for breakfast before going to work, while spring rolls are eaten rather infrequently. One might then ask, “So what is the typical home cooking in Vietnam?” Well, according to one of the author’s Vietnamese acquaintances, stewed pork cubes, water spinach, and porridges are most common. The recipe for stewed pork is very similar to that of its counterparts in China and Japan, and is characterized by the thick, sweetened flavor typical of southern Vietnam. Native to Southeast Asia, water spinach is one of the most commonly used vegetables in Vietnam. Often eaten stir-fried with garlic, it is quite a delicious ingredient. In every Vietnamese household,

rice, pork, and water spinach have long been key ingredients in their meals. That same Vietnamese acquaintance, who spent his childhood in a farming house in the Mekong Delta, said that raising pigs at home was a matter of course. Now people give pigs special feed, but in those days leftover rice and noodles were given to the animals for food. Water spinach, which grows everywhere and is thus easily available, was the pigs’ favorite food. To put it simply, people and pigs live together on the same food, and people consume the meat from the pigs. As one might expect, this chain-like cycle of people, pigs, rice, and water spinach has had no small influence on the spiritual foundation of Vietnam’s people, as well as its food culture. Another common example of home cooking, porridge is also heavily involved with pork. One particular variety of porridge called *chao long* is made by boiling pig internal organs with rice. It is not only delicious, but also a dish that expresses gratitude toward life by “consuming every last part of the pig.”

Whether consciously or otherwise, the Vietnamese have partaken of the bounties of the Mekong River, such as rice, with a sense of genuine gratitude from bottom of their hearts. Perhaps it was in this setting that their often-noted diligent and honest character was nurtured, along with the unyielding mindset that has helped them to overcome a history of hardships.



**< Food
Vietnam**

Water spinach at a market in My Tho. As the meaning of its Chinese name (empty core greens) suggests, its stem is hollow.



At a farmhouse in the vicinity of Ho Chi Minh City, water spinach flowers bloom in profusion and pigs are kept at the corner of the house.

**II Reviving Chaohu Lake,
a Wellspring of Life
Environmentally friendly water circulation project
in the vicinity of Hefei in China’s Anhui Province**

The 21st century has been referred to as the century of water – this appellation refers to the increasingly limited supply of water on a global scale, which is arising from the population explosion, rapid economic growth and urbanization, water pollution, and global warming. As issues revolving around water resources draw international attention, water-related issues are also emerging in China. As China’s population steadily increases, its water resources are becoming scarce while water pollution worsens throughout the nation. The serious water shortage in China stems primarily from declining water quality due to contamination, in addition to the absolute shortage and geographical/seasonal misdistribution of water. To address these matters, the Chinese Government provided the necessary legislation and in 2002 opened its water supply and sewerage works operations to private businesses in the country and also to overseas businesses, which prompted one Western “water major” after another to come to China, thus creating a large and vibrant market fuelled by the remarkable growth of the country’s economy. Some statistics show that as many as 2,000 sewage treatment plants were built (or started construction) within a span of only seven years. Nevertheless, the quality of water along the country’s major basin areas is slow to improve. It was against this backdrop that Kubota participated in an environmentally friendly water circulation project in the rural vicinity of Hefei in Anhui Province. Reported here are the present situation and challenges of this ongoing project, which we hope will provide inspiration for the “future of water” in China.



“Agricultural Nonpoint Source Pollution” – the Main Source of Water Contamination in Rivers, Lakes, and Marshes

The world faces an imminent and serious water shortage on a global scale, but the situation is becoming especially severe in China. According to data compiled by the Water Resources Department of the Ministry of Land, Infrastructure, Transport and Tourism of Japan (*Water Resources in Japan, 2009*), the total volume of annual internal renewable water resources in China is 2,830 billion m³ (the 6th greatest in the world), but China's average per capita volume is 2,130 m³, only a quarter of the global average of 8,372 m³, thus making China one of the countries with the least water availability in the world. In China, distribution of water resources is extremely uneven: the Tibet Autonomous Region and Qinghai Province boast an overwhelmingly large volume of water resources, whereas elsewhere the volume of average per capita internal renewable water resources is far below the global average. On top of the absolute shortage and misdistribution of water resources, water pollution and other human factors can often be found at the root of China's water problems. The single biggest factor contributing to the aggravation of water pollution in the country is the increasing emissions of industrial effluent and household sewage as the country undergoes economic development. Of course, the Chinese Government has not just been sitting idly by, but has undertaken a series of programs designed to improve water quality, which proved to be reasonably successful in combating the effects of industrial effluent. Sewage treatment has advanced in urban districts, with the diffusion rate of sewage treatment plants topping 70%.

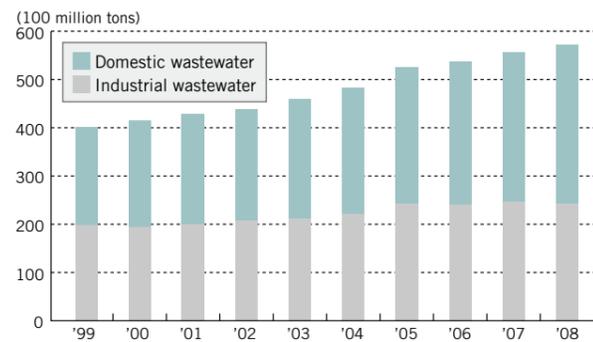
At the Wang Xiao Ying Wastewater Treatment Plant (the largest in Hefei), 300,000 tons of wastewater is treated every day.



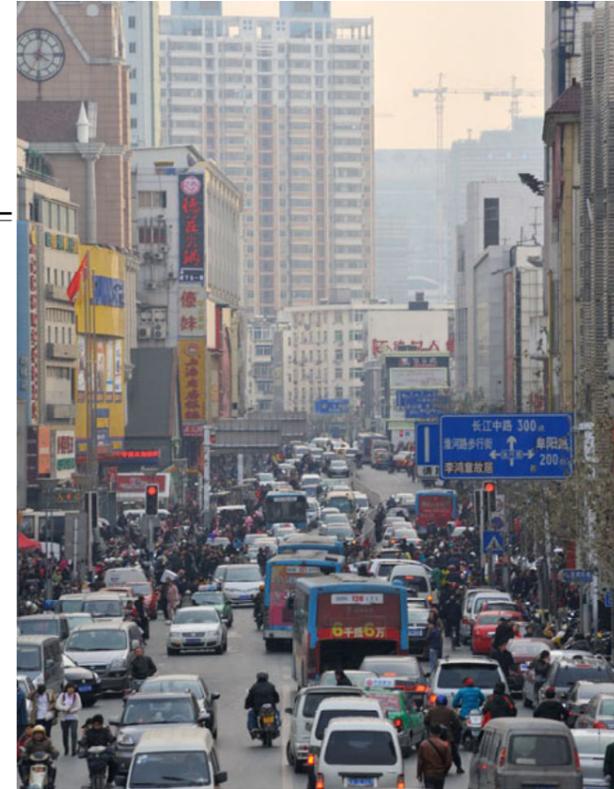
However, water from many of the country's seven water systems including the Yangtze and Huang He Rivers – major sources of water for drinking, agriculture, and industrial use – are still unfit for human consumption, although some improvements have been made in recent years. Among China's rivers and lakes, the three most polluted rivers are the Huaihe, Haihe, and Liaohe Rivers, and the three most polluted lakes are Chaohu, Taihu, and Dianchi Lakes. They have all come to symbolize China's water pollution, but what is it that prevents the water quality in the three rivers and three lakes from improving?

Actually, it has become nearly certain that agricultural nonpoint source (NPS) pollution is a major cause of the situation. As one might guess from the term itself, it entails a situation in which sources of environmental pollution in farming areas spread over a wide area. One need only glance at the percentages of the total volumes of contaminants in the country represented by contaminants of agricultural origin to realize how serious NPS pollution is. Agricultural sources are responsible for 43.7% of the total COD (chemical oxygen demand) discharge, which is one of the most frequently used indicators of water pollution, 57.2% of the total nitrogen discharge, and 67.4% of the total phosphorous discharge (*China's Bulletin on the First National Census on Pollution Sources*, February 2010). The nitrogen and phosphorous discharges, in particular, are the largest causes of eutrophic lakes and marshes. Located in areas surrounding cities, farming villages are home to all kinds of water pollution sources, such as domestic wastewater (raw sewage and miscellaneous drainage), livestock wastewater (animal excrement), and food processing wastewater (waste from slaughterhouses), in addition to

Industrial/domestic wastewater effluence in China



Source: Data compiled from the *Bulletin on National Environmental Statistics*, Sino-Japan Friendship Centre for Environmental Protection



Hefei also boasts the site of a famous ancient battle during the Three Kingdoms Period. – At Three Kingdoms New City Park

An ancient city with over 2,000 years of history, Hefei has transformed itself into a modern city.

< Hefei

huge quantities of domestic waste, which are either left as they are or sent to landfill. Nevertheless, the level of waste treatment is quite low. In rural areas, the percentage of sewage treatment is less than 20%, food waste is left untreated, and the majority of domestic wastewater and livestock excrement is either subjected to simple treatment or discharged into rivers, etc. without being treated. Such being the case, China cannot hope to purify its water without eliminating the causes of pollution, and so fundamental and drastic solutions are being sought. There are no few districts, mainly in the areas near the “three rivers and lakes,” that share such water problems, and among them we visited Hefei in Anhui Province, which neighbors one of the “three lakes,” Chaohu Lake, and plays host to a project that Kubota has participated in.

Sino-Japan Bilateral Collaboration Takes Off Toward a Win-Win Relationship

About a 90-minute flight south from Beijing, Anhui Province is located around the central portion of the Yangtze River in East China. Located almost at the exact center of the province is Hefei, its capital city with a population of nearly 5 million (China's administrative divisions are on the provincial, municipal, prefectural, county, township, and village levels. Those at the level of prefecture or lower around urban districts are defined as rural areas.). Hefei is the regional center of politics, economy, and culture. Although it is just another local city, this provincial capital is able to provide a firsthand glimpse of present-day China, which is undergoing rapid economic development. Perhaps most symbolic of this

economic development is the feverish boom in construction of housing complexes and other high-rises. One can easily find skyscrapers under construction nearly everywhere in the city. We visited the city in late January, and with the Chinese (Lunar) New Year's Day close at hand, the streets were bustling with people getting ready to ring in the New Year.

Before going into the details of the project, we will provide a quick overview of its background. The project originated when the Japan-China Economic Association¹ was commissioned by the Ministry of Economy, Trade and Industry of Japan to undertake a fiscal 2008 project for reinforcement of industrial infrastructures in Asia (a survey on cooperation that contributes to the development of China's water investment environment). This project had been induced by a question raised by the Anhui Provincial People's Government Development Research Center, a policy recommendation think tank under the direct management of the provincial government. One of the nation's three most polluted lakes, Chaohu Lake in Anhui province, was designated by the national government as a priority improvement district, and anti-pollution programs were implemented accordingly. However, they had yet to produce any sustainable and effective results, even though its water quality was temporarily purified. This was due to the failure to take drastic actions against water contamination derived from NPS pollution, which originated in areas scattered along the Chaohu Lake basin and around Hefei. The Anhui Provincial People's Government Development Research Center then came up with a solution: by purifying the waters (NPS polluted areas) pouring into Chaohu Lake, they believed that they could improve its

water. This idea then gave birth to a scheme whereby pollution is reduced while generating energy by introducing and spreading a system that uses contaminants to generate and utilize methane. Based on this plan, the Japan-China Economic Association sought cooperation from Kubota and other Japanese companies to further solidify such discussions. When the project was adopted as an invitation project by the New Energy and Industrial Technology Development Organization (NEDO), the project took off. One of the people responsible for the scheme, Deputy Director Dai Peikun of the Anhui Provincial People's Government Development Research Center defined the significance of the project as follows.

"First of all, what we are doing is implementing environmental protection through collaboration and cooperation between Japan, a fully-fledged economic power, and China, a country in the middle of its economic development. This is one kind of international exchange between our two countries. Secondly, this project allows Japanese companies to expand their market, and at the same time China can also introduce technology, thereby creating an international win-win situation. Thirdly, the project is perfectly aligned with China's reform and door-opening policies. We hope to make this project a success as one of China's pioneering efforts."

The project is also conducted in accordance with the directions laid out in the 12th Five-Year Plan (the major goals for economic and social development for the upcoming five years presented as a national strategy), which was adopted at the plenary session of the Central Committee of the Communist Party of China held in

Dai Peikun, Deputy Director, Anhui Provincial People's Government Development Research Center



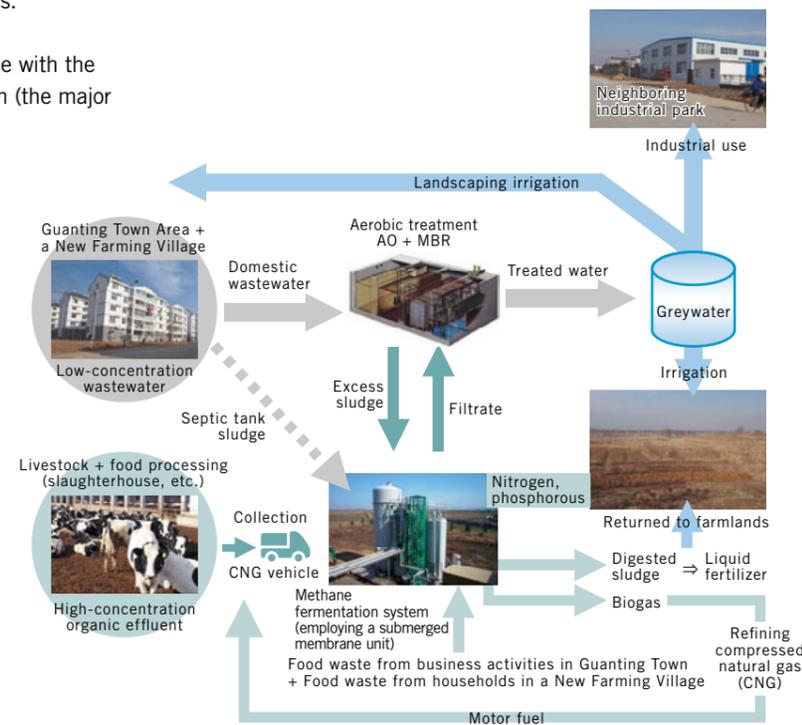
October 2010. According to the Plan, the country will begin intensive construction of small-scale effluent treatment facilities in rural areas throughout China during the five-year period. It is thus expected that the outcome of this project will serve as a model for China to develop future standards and guidelines concerning the development of sewage treatment plants in rural areas, among others.

***1 Japan-China Economic Association**

A special incorporated foundation established in 1972 under the jurisdiction of the Ministry of Economy, Trade and Industry. With support from the Japanese government and economic and industrial sectors of the country, the association has been involved in projects designed to promote economic and technical exchanges between Japan and China for many years.

Improving the Rural Environment "MBR" and "Methane Fermentation"

The entire purpose of this project is to comprehensively and efficiently treat the water pollution resources that are characteristic of rural areas, which were usually treated individually, and to create an environmental management system that may be sustained long-term by providing the



Concept image of the model project in Hefei, Anhui Province



Eutrophication due to water pollution and breakouts of blue-green algae – The safety of drinking water from lakes is questioned throughout China.



The water quality of Chaohu Lake is continuously measured at the Water Quality Monitoring Center, which is connected online with the China's Ministry of Environmental Protection.



Zhao Shunsuo, Chief Engineer, Hefei Municipal Environmental Protection Bureau

local community with greywater, biogas, fluid fertilizers, and other byproducts that may be created, for a fee. Let us take a look at the process. Domestic wastewater (low-concentration wastewater) is first treated by a membrane bioreactor (MBR). Kubota's submerged membranes are often used in MBRs at water treatment facilities in Japan, Western countries, and other parts of the world, and are highly reputed for the stable quality of their treated water. A major advantage of the MBR is its compact size compared to conventional water treatment facilities, and its ability to produce processed water that can be recycled for use as industrial greywater. To treat sludge discharged by MBRs and livestock excrement, a methane fermentation technique is introduced. The project also aims to collect food waste from restaurants and other locations in rural areas that serve as a source of major environmental issues. Collected food waste is treated by a methane fermentation system employing a submerged membrane unit (KUBOTA Anaerobic MBR), and biogas from the fermentation process is efficiently collected in a stable manner. Byproducts generated from the treatment process are put to efficient use: treated water discharged by the MBR (greywater) is recycled for use as industrial water, irrigation water, and water for landscaping. Biogas generated during methane fermentation is used for motor fuel, and digested liquid discharged after the membrane methane fermentation process is returned to farmlands as fluid fertilizer, since it contains an abundance of fertilizing components such as nitrogen and phosphorus.

By establishing this "water-saving, environmentally friendly water circulation system" at different locations

along the priority basin areas in a geographically optimal manner, China eventually hopes to control the discharge of agricultural nitrogen, phosphorus, and other chemicals into water systems in the areas surrounding metropolitan cities, thereby improving the water quality of rivers and lakes along the basins and ensuring sources of safe water in each community. The de facto leader of the project on the Chinese side and Chief Engineer of the Hefei Municipal Environmental Protection Bureau, Zhao Shunsuo is originally from Hefei.

"As a child, I grew up drinking water from Chaohu Lake and swimming in its waters. For me, the beautiful sight of Chaohu Lake is an archetypal image of my hometown, and it is also a wellspring of life. So for me, improving the quality of its water is like a personal mission. This project entails various issues, but I am sure that it will be a great success if we share a common awareness of the problems to discover solutions to them through closer communication with Kubota."

While Mr. Zhao is very enthusiastic, unfortunately it will not be so easy to uncover solutions to the various issues that he pointed out regarding this project. One such issue is how to collect domestic waste and livestock excrement, which are currently used for land reclamation, left as they are, or dumped. Who will collect them, and how? Who will be responsible for the collection costs? In other words, it will be necessary to develop from scratch a social system for collection, implement a fee-based system, and solicit the understanding and agreement of farmers and others concerned. Another major obstacle is the disposal of fluid

Yasushi Terao, General Manager,
Overseas Project Management
Department, Water & Environmental
Systems Consolidated Division



An old street in Sanhe (Three Rivers)
Ancient Town, so called because three rivers
that pour into Chaohu Lake
(the Fenge, Hangbu, and Xiaonan Rivers)
run near the town



Atsushi Tanigawa, Anaerobic MBR Team,
Overseas Project Management
Department, Water & Environmental
Systems Consolidated Division



Plant site in the Guanting Industrial Park, Feixi County,
Hefei City. Here, black water from the central Guanting area
populated by 20,000 people will be treated.
Domestic wastewater from the neighboring New Farming Village
(population: 6,000) will be also sent here.

Hefei City and Chaohu Lake



Treated water is recycled as greywater at
an industrial complex for migrant farmers
that neighbors the plant to the south



fertilizer, a byproduct of the treatment process. To begin with, farmers are not inclined to use fertilizers generated from polluted water, and so it is highly doubtful that they would be willing to purchase such fertilizers for a price. As a solution, the project team is considering such options as temporarily distributing the fertilizers for free in order to promote understanding among farmers. Nevertheless, there are no few matters that need to be addressed, including pricing and transportation costs.

“We are currently working on this project, charged with the mission of assisting China in its efforts to conserve the environment and at the same time expanding our environmental business there. We have a system that is highly recognized, but when it comes to how we can get the system going (namely, collecting wastes, charging fees, and conducting sales), it will be necessary to coordinate various issues among the parties concerned, including farmers and businesses. This will require us to share a common understanding with a broad range of people there that we will make good business sense out of this project, and we hope to create a new business model along the way. This project is a critical test for Kubota’s environmental business in China. We are determined to make it a success so that we can make dynamic inroads into the gigantic market in China.” (Yasushi Terao, General Manager, Overseas Project Management Department, Water & Environmental Systems Consolidated Division)

“Lateral Expansion” of the Project Kicked Off as Demonstration Facility Goes Into Operation

Because the project is funded by NEDO, it is subject to “Stage Gate” reviews by that organization for each phase. The requirements of each review must be fulfilled for the project to continue. After its official adoption, the project was launched in June 2009. In Phase I, detailed studies were made of the local needs and systems based on field surveys in order to select a site for the project, and simplified design was conducted for a water-saving, environmentally friendly water circulation system. At the same time, counter partners at local governments were chosen and the feasibility of the project was studied. Upon NEDO’s approval of these programs in Phase I, the project moved on to Phase II in April 2010 to create a detailed design of the system to be built on the site that was selected during Phase I. If Phase II is successfully completed (review scheduled for late March 2011), construction and then operation of the project’s demonstration facility will commence.

“It must be noted that this plant, which will be constructed and operated following approval at NEDO’s review, is for demonstration purposes. As we manage the plant, we are planning to spend about two years in the verification process, which will include collection of necessary data, performance verification, and quality

assurance. It is, so to speak, a pilot program. After the completion of that process, we will then be able to proceed to contractual negotiations, installation of the actual system, and commercial operation. However, we do not intend to spend these two years only on demonstrations. During the demonstration phase, it will be necessary to impress the Hefei municipal government for conclusion of the contract, but at the same time we will give demonstrations for other districts as well.” (Atsushi Tanigawa, Anaerobic MBR Team, Overseas Project Management Department, Water & Environmental Systems Consolidated Division)

More specifically, Kubota hopes to leverage this project for “lateral expansion” of its environmentally friendly water circulation system beyond the vicinity of the project site to reach the entire land of China by customizing the system according to the specific needs of host communities. Herein lies a huge amount of business opportunities, both potential and apparent, but the existence of Japanese competitors as well as “water majors” from the West makes the competition extremely intense. For Kubota to successfully compete, we are required to build a highly competitive plant with superior functionality and quality, and to “demonstrate and promote its expansive sustainability as a business” (Yasushi Terao).

Guanting Town – Demonstration Facility and Plant Site Government-led Construction of a “New Farming Village”

The site for the demonstration facility and plant is Guanting Town in Feixi County, which is about one hour’s drive from the center of Hefei City. The location was deliberately chosen because domestic wastewater, livestock excreta, food waste, and waste from restaurants can all be collected from within a radius of 10 km. The Guanting Town center is populated by about 20,000 people, with roughly 6,000 residents living in nearby Fengzhuang/Mahewan New Village, and there are some 100 restaurants in the vicinity. A dairy cow pasture, pig farm, and slaughterhouse also exist within a radius of 10 km. We visited the cow pasture and slaughterhouse, but were unable to observe how livestock waste and blood from slaughtering are treated. It was explained that part of the cow excrement is used for methane fermentation, but much of it is left on the ground without any treatment and only some is diverted into fertilizing manure.

Officials of the Guanting Town People’s Government then took us to a “New Farming Village.” However, it should not be thought of it as a farming village full of pastoral scenery. It is one of the “New Farming Villages” whose development the Chinese Government is driving as a key policy. With the goal of correcting differentials

between urban and rural areas, this policy initiative involves an attempt to create “new” farming villages by pouring more resources into the development of infrastructures there, so as to ease the burden of farmers, diffuse compulsory education, and improve the environment in such villages. Behind all of this are the “Three Rural Issues,” which stand as major challenges for the Chinese Government. Specifically, they address farming modernization, social infrastructure development in rural areas, and eradication of poverty among the farming population. “New Farming Villages” are the government’s trump card against these looming concerns in modern China, and they are rushing to construct such settlements throughout the country. Here in Guanting, a residential zone has been developed complete with modern housing and infrastructures, which are made available to 6,000 people comprising 1,600 households from two villages, who had previously lived spread out across 1,300 ha of land. Now the populace lives together in this “New Farming Village.” At a glance, it looks very much like one of Japan’s “new town” housing complexes, although the sight of spacious fields behind the row of apartment buildings

Housing complexes in Fengzhuang/Mahewan New Farming Village. They would be difficult to recognize as farmers’ residences without the sight of agricultural machines on the street.



indicates that this is a farming village. We did not have a chance to see the interior of those units, but we were again informed that a comfortable living environment is offered, fully equipped with electronics and infrastructures including water supply and sewerage.

The success or failure of this policy measure to construct New Farming Villages is said to be one of the keys to predicting the future of China’s political system. There are no few people who say that many of the issues that the country is now faced with would be resolved if its farming population of 800 million people could benefit from this construction project and be (even slightly) better off. Nevertheless, there are still many more hurdles to cross before one of the basic policies of the Chinese Communist Party’s New Farming Village Construction Plan becomes reality as a goal for these New Farming Villages, i.e., “by advancing democratization of the farming population, protecting villagers’ rights, and expanding autonomy, farmers will play the lead role in rural areas.”

It was explained that a portion of livestock excrement from a dairy cow pasture is used as fertilizer on farmlands.



Drainage from slaughterhouses currently discharged into streams will be treated at the new plant.



Women doing laundry in a pond. Washing clothes while beating them might be the best thing for clothing dirtied during farm labor...

Scenic Laoshan Island on the lake



Rows of high-rise condominiums in the new area

On the lakeshore, fish are dried and beside it fresh catches from the lake are sold on the street. With whitebait, shrimp, and crabs from Chaohu Lake referred to as the “Three Treasures,” the bounties of the lake have enhanced the lifestyle of people living nearby.



Sorrowful Chaohu Lake, the Neo-Futuristic Landscape of a “New Area”

Against a biting cold wind we made our way toward Chaohu Lake, which has come to be a kind of symbol of water pollution in Hefei City. Located along the Yangtze and extending across the three cities of Hefei, Chaohu, and Lu’an in the central part of Anhui Province, Chaohu Lake is the fifth largest freshwater lake in China, with a surface area of 778 km² (approximately 1.2 times larger than Lake Biwa, Japan’s biggest). Approximately five million people live near the lake, and its water is used for irrigation, drinking, fishing, and transportation. Blessed with abundant sources of water, the populated area around Chaohu Lake has long been known as a “town of fish and rice.” The lakeside area is a popular tourist destination during the summer. Stores selling lake products and private home lodgings were lined up by the lake, which is reminiscent of a rustic fishing town in Japan, and we also saw a small market selling catches from the lake. Under the cloudy winter sky, Chaohu Lake may at a glance appear to be simply a vast expanse of water, but according to explanations its surface turns an unpleasant green hue between April and September every year, as a massive proliferation of blue-green algae peaks in June (In recent years, however, the occurrence of blue-green algae is on the

decline as the national government has implemented measures to purify lake waters and built sewage treatment plants in metropolitan areas.). The primary reason for the occurrence of blue-green algae is eutrophication caused by pollution sources from rural areas. Effluence from all types of pollution sources, including domestic wastewater, waste from stock farms and food processors, and a large quantity of domestic garbage, agricultural chemicals, and chemical fertilizers, are pouring into Chaohu Lake via nearby rivers. Although Hefei City no longer draws drinking water from the lake, Chaohu City at the east end of the body of water still uses it for consumption. Further aggravation of water quality can make it literally undrinkable, and it has also been reported that fish catches are decreasing due to the declining quality of water. We rent a motorboat to sail to Laoshan Island, famous as a picturesque location situated in the middle of the lake. From the top of the island, we took in the view of the lake as it ripples in the chill wind. Perhaps it was an effect of the cloudy sky, but the lake seemed to have taken on a somehow sorrowful appearance.

Around Chaohu Lake one can see various scenery scattered about that would remind most Japanese people of old-fashioned farming villages. Hidden beneath this tranquil landscape, however, are the causes of agricultural NPS pollution, a thought which is

somewhat frustrating but also forces one to realize the complexity of the problem. However, such sentimentality is soon banished. Located in Hefei City, the Binhu New Area faces the northwestern shore of Chaohu Lake. As the term would suggest, "New Areas" are newly created neighborhoods that are being developed one after another in local cities in China. In a sense, the Binhu New Area could be described briefly as a neo-futuristic residential area, and along the grid-like network of wide arterial roads is a seemingly endless row of elegant high-rise condominiums. Construction of those skyscrapers began several years ago, and as of now housing for 7,000 households has been built. One could even say that this is the epitome of the ever-soaring Chinese economy, but it is a somewhat a strange sight as there are hardly any passers-by. We are told that many of the condo units are purchased for investment, but this certainly mirrors one aspect of China's "housing bubble." New Farming Villages, Chaohu Lake, old farming villages, New Areas ... present-day China is vividly depicted in the dizzying gap between them.

**Toward Creation of a Recycling Society
Greater Environmental Awareness
Necessary among Farmers**

One of China's biggest policy agendas concerns how to maintain social stability. This is because China is a multiethnic country, but also results from the fact that, historically, popular upheavals have broken out toward the end of the dynasties of each period, triggered by economic differentials between urban and rural areas. In other words, no matter how prosperous urban areas may become, no country can remain unaffected if stability in rural areas is threatened. Amid the rapid economic

growth in recent years, there have been a great number of media reports about the widening gap between urban and rural areas in China. One of the priority policies designed to narrow this gap involves finding a solution to the Three Rural Issues I mentioned earlier. Environmental conservation in rural areas plays a major role in addressing these issues, and improvement in the environment is considered to lead to a higher standard of living. In the past, there has been a tendency to apply environmental regulations in rural areas that are less strict than those in urban areas because of the relatively low economic levels in the countryside. Now that it has become clear that the sources of pollution of major water systems lie in rural areas, however, it is expected that environmental regulations in such areas will be tightened. In order to create a sustainable society or recycling society, it is clear that each individual farmer needs to have greater environmental awareness. One must pause to think here, however. The new area's neo-futuristic landscape hovers like a mirage over what was once farmland. How much awareness of water quality issues and the environment exists among people living in those neighboring villages? At the zenith of its growth, the ever-heating Chinese economy seems to be driving its people to desire affluence, but it is never easy to improve the environment of rural areas in such a situation. Nonetheless, enhancement of environmental awareness among the people, including farmers, will surely hold the key if China wishes to work toward achieving a recycling society from now on. After all, the "future of water" in China rests on the shoulders of each individual Chinese. On the way back from Chaohu Lake, I look once more at the misty lake surface. I could be wrong, but it seemed to me that two faces were present in the lake's expression – representing both sorrow and hope.

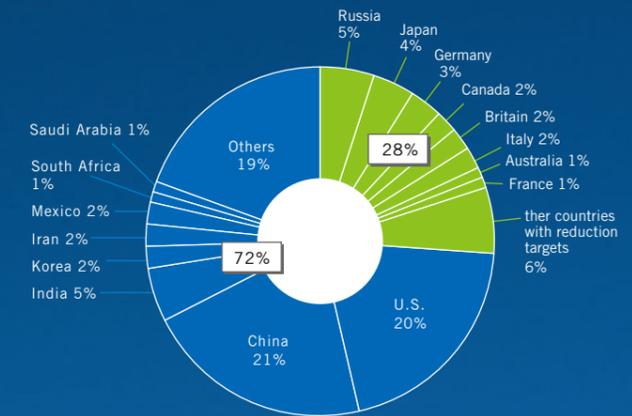


Many farmers engage in their daily work in the old villages.



III Milestone in the Fight against Global Warming
Chubu Sewage Treatment Center, Hamamatsu City
Reducing CO₂ emissions by converting the fuel of a sewage sludge incinerator

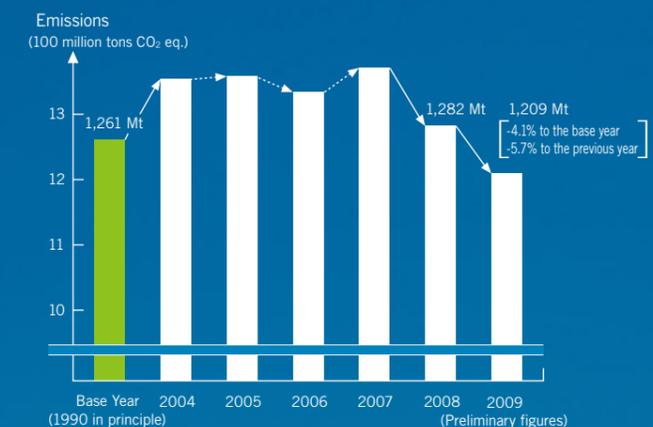
The 16th session of the Conference of the Parties of the United Nations Framework Convention on Climate Change (COP16) was held in Cancun, Mexico, from November 29 to December 10, 2010. Like other recent rounds of this annual conference, one of the key agendas at COP16 was to create a framework that would replace the Kyoto Protocol, which was agreed upon at COP3 held in Kyoto in 1997 (effective from 2005) and will see the end of its commitment period in 2012. The Kyoto Protocol set clear greenhouse gas emission reduction targets for developed countries¹ over the five years from 2008 to 2012: 6% for Japan, 7% for the United States (non-signatory), and 8% jointly for the European Union, as compared to 1990 emission levels. Total emissions in Japan had remained high even after the Kyoto Protocol went into effect, but began to decrease after peaking at 1,371 million tons in fiscal 2007. In fiscal 2009, total emissions decreased by 5.7% compared to the previous year to 1,209 million tons (preliminary figure), representing a 4.1% decrease compared to those of the base year of 1990 and coming within range of the 6% reduction target.



CO₂ Emissions from Energy Sources (2007)
[Shares of Countries with Reduction Targets
under the Kyoto Protocol]

Annual Report on the Environment, the Sound Material-Cycle Society and the Biodiversity in Japan 2010, Ministry of the Environment

At the recent COP16, the proposal for a simple extension of the Kyoto Protocol commitment period to 2013 and beyond gathered momentum. Japan voiced a strong objection, which can certainly be considered fair. One is naturally forced to question the viability of the current system, wherein the world's two largest greenhouse gas-emitting countries – China and the United States – are not obliged to reduce such emissions. Furthermore, it is not only developed countries who are the primary sources of greenhouse gas emissions, as emerging and developing countries are now experiencing economic growth. Sure enough, the task of creating a framework to combat global warming in 2013 or thereafter has been deferred until COP17, which is scheduled to take place in South Africa toward the end of 2011. This begs the question as to whether the world is truly facing up to this urgent problem that involves factors that threaten not only the natural environment, but the very future of humanity itself. International society has set for itself the goal of cutting the world's greenhouse gases in half by 2050. If Japan is to be an "environmentally advanced country" in terms of both engineering and awareness, it will be required to persistently pursue negotiations with China, the United States, and emerging and developing countries toward the creation of a fair and viable international framework.



Japan's National Greenhouse Gas Emissions
Japan's National Greenhouse Gas Emissions in Fiscal Year 2009
(The Preliminary Figures), Ministry of the Environment

*1 The Kyoto Protocol's emission reduction targets cover carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆).

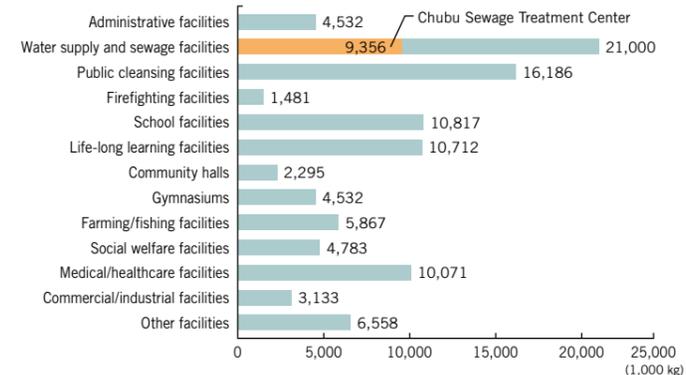
Reducing CO₂ by Introducing High-efficiency, Energy-saving Circulating Fluidized Bed Incinerators

While countries across the globe are discussing measures to prevent global warming through international diplomatic measures such as those represented by the COPs, a variety of grass-roots initiatives are taking place throughout the world in pursuit of this common cause. Japan is no exception, as the bitter experiences of social problems caused by pollution during its rapid economic growth period have prompted both the public and private sectors of the country to take positive approaches toward solving environmental issues. Addressing the problem of global warming, not only governments and enterprises, but other groups and organizations as well are making steady efforts to reduce greenhouse gases. The country's local governments, too, are proactively tackling this issue, and Shizuoka Prefecture's Hamamatsu City is one such "environmentally advanced" city in Japan.

Overlooking the Sea of Enshu and known for its mild climate, Hamamatsu is an ordinance-designated city with

a population of more than 800,000 people. Of the many environmental conservation projects that this city has undertaken so far, one that is drawing considerable attention is "Operation CO₂·CO₂ (pronounced *kotsu-kotsu* in Japanese, meaning 'little by little') Diet," an action plan for combating global warming that was launched in 2008. The municipal government has a wide range of business activities, which include not only clerical and reception work but also waste disposal management, water supply and sewage work, and management of schools, fire stations, hospitals, and the like. This makes it one of the largest sources of CO₂ emissions generated by a single business operator in the city. The project was started to reduce the CO₂ emissions produced by the local government.

"This project aims to help reduce CO₂ emissions throughout the city by implementing measures to reduce greenhouse gases. In addition, we are encouraging residents and businesses to take every opportunity to reduce their CO₂ emissions by setting a model for them to follow." (Motoi Nasu, Director, Sewerage Construction Division, Water Services Department, Hamamatsu City)



Annual CO₂ Emissions from Energy Consumption in Buildings, etc. in Hamamatsu City (By facility type, FY2005)

Action Plan of the Hamamatsu Municipal Government to Prevent Global Warming (Phase II)



Circulating fluidized bed incinerator (Incinerator No. 2)

With that objective in mind, city officials took note of the sewage sludge incinerator at its Chubu Sewage Treatment Center, which was responsible for the largest amount of CO₂ emissions among the facilities managed by the city (9,356 t/year in FY2005, or 9.2% of the total of all city facilities). At sewage treatment plants, sewage is separated into water and sludge, the latter of which is burned up by a sewage sludge incinerator after the condensation and dewatering processes. The sewage treatment process at the facility in Hamamatsu – and every facility of its kind, for that matter – emits a large amount of CO₂ throughout the treatment process. With the spread of sewage systems, this discharge increased by some 54% between 1990 and 2006, making reduction of CO₂ discharged from sewage treatment a policy agenda on the national level. As such, the Japanese government took up reduction of CO₂ and other greenhouse gases through promotion of energy conservation and introduction of new energy sources for sewage systems, and included it in the Kyoto Protocol Target Achievement Plan.

The origins of this ambitious project to reduce CO₂ emissions at Hamamatsu City's sewage sludge incinerator can be traced back to 2005, when Kubota's circulating fluidized bed incinerator was introduced. In the early 2000s, a new trend was developing in the sewage sludge incinerator market – the development and introduction of circulating fluidized bed incinerators, which feature improvements over conventional incinerators.

The impetus behind this trend was a change in the nature of raw sludge. Primarily owing to the split-flow

treatment of rainwater drainage and domestic wastewater in recent years, the ratio of organic substances coming from inflow sources has increased, thus creating "calorie-rich" wastewater. In addition, the shift from lime to polymer coagulant as a dewatering aid has tended to add more calories to dewatered sludge. In response, demand was high for an incinerator capable of burning up such sludge with greater speed, using less energy, and generating less CO₂.

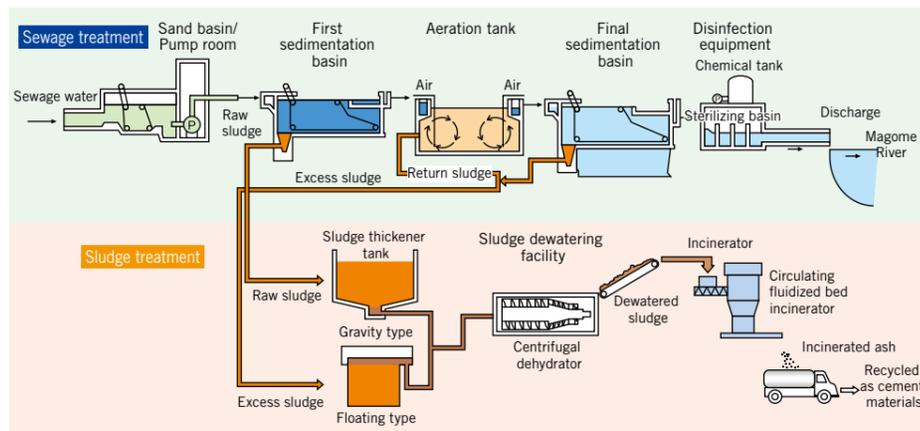
The circulating fluidized bed incinerator uses high-temperature circulating sand as a heat medium for the instant dispersal and drying of sludge for incineration. This incinerator is characterized by improved efficiency, energy conservation, and compact size. Because its combustion efficiency is higher than that of conventional incinerators and a higher combustion load (calorific value within the combustion chamber) may be tolerated, the incinerator can be made more compact. Also, thanks to the low air power requirements necessary for sand circulation, flow power requirements have been substantially reduced. High fuel efficiency has also been achieved by collecting high-temperature combustion air from the incinerator exhaust gas.

At the time, sewage sludge incinerators in Hamamatsu City were undergoing a replacement period. Due to the need to respond to higher-calorie sludge, the introduction of circulating fluidized bed incinerators was considered. In fact, however, there were some who questioned the adoption of such incinerators. There were still only a few local governments across the country that had introduced them, thus giving rise to serious concerns over the risk of

Hamamatsu >



Main entrance of the Hamamatsu City Chubu Sewage Treatment Center



Treatment flow at the Chubu Sewage Treatment Center



Motoi Nasu, Director, Sewerage Construction Division, Water Services Department, Hamamatsu City

unstable operations.

“Around 2001, we made technical presentations of our circulating fluidized bed incinerators, and we did not miss the opportunity to stress their environmental capabilities. They control dioxin production, help to reduce CO₂ emissions as an overall result of their highly efficient energy-saving capabilities, and – this is an important point – offer solutions for the N₂O (nitrous oxide) that is discharged from sewage sludge incinerators. N₂O has greenhouse effect about 300 times greater than that of CO₂, and the circulating fluidized bed incinerator drastically reduces emissions of that gas by incinerating sludge at a higher temperature. Stable incineration is, first and foremost, required as the fundamental premise, but we also emphasized the superior environmental functions of our incinerators.” (Osamu Yokota, Assistant Manager, Sludge Melting Furnaces & Incinerators Engineering Team, Overseas Project Management Department, Water & Environmental Systems Consolidated Division)

Subsequently Kubota began construction of the incinerator in 2002. The incinerator was put into operation in 2005, making it possible to incinerate 60 tons of sludge daily. From the perspective of the fight against global warming, it should be noted that the introduction of circulating fluidized bed incinerators is remarkable in that it not only drastically reduced N₂O generation, but as an energy-conserving facility it also helps to reduce CO₂ emissions. Compared to 2005 levels, CO₂ was successively reduced by 4.48%, 7.78%, and 9.19% in the following three years.



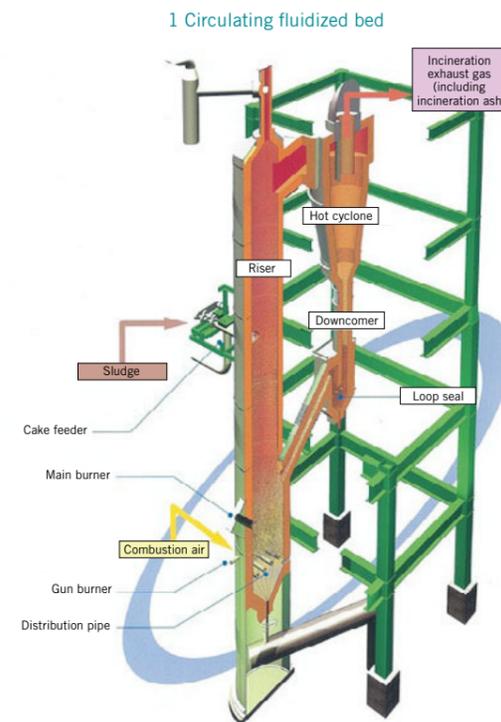
Osamu Yokota, Assistant Manager, Sludge Melting Furnaces & Incinerators Engineering Team, Overseas Project Management Department, Water & Environmental Systems Consolidated Division



Akikata Yamada, Associate Manager, Water & Sewage Engineering Sales Department

Fuel Switchover from Kerosene to Natural Gas – Meeting Needs Promptly and with Precision

In 2008, Hamamatsu City set a clear target: reducing FY2010 CO₂ emissions at its Chubu Sewage Treatment Center by 19.2% compared to the levels in FY2005. The trigger for this decision was a price hike of crude oil, the primary fuel source of the incinerator. At that time, oil prices soared to US\$140 per barrel, which in turn pushed up the price of the kerosene that was used for their sewage sludge incinerator. Something had to be done to trim fuel costs. It was then that Hamamatsu City came up with the idea of switching the incinerator’s fuel from kerosene to natural gas, which sounded like a brilliant idea as it would not only stabilize costs, but also reduce CO₂ emissions. However, there had been no precedent for a fuel conversion from kerosene to natural gas. And so, they turned to Kubota for technical consultation.



Dewatered sludge (in the form of dewatered cakes) is fed here. 2.5 tons of dewatered sludge per hour is inserted into the continuous type incinerator



Interior of the incinerator as seen from the viewing window. By switching from ordinary incineration (800°C) to high-temperature incineration (850°C), the circulating fluidized bed incinerator can reduce N₂O emissions by approximately 60%.



Circulating fluidized bed incinerator (base)



Pressure gauge for city gas supplied to the gun burner



Three gun burner (gas gun) units are installed in the incinerator.

Incinerator monitoring console screen



“The first thing that they asked was if we could even switch the fuel to natural gas in the first place. They also requested that reduction of CO₂ emissions and costs be taken into consideration. So, I sought cooperation from the departments concerned to prepare materials for our proposal and lost no time in visiting them. According to our provisional calculations, we found that we could reduce a large amount of CO₂ emissions. Of course, a prerequisite for this was stable operations free from any technical or maintenance problems after the conversion to natural gas.” (Akikata Yamada, Associate Manager, Water & Sewage Engineering Sales Department)

In simple terms, fuel conversion from kerosene to natural gas involves an attempt to replace the burner running on kerosene with one that runs on natural gas. To make this project a success, it was necessary to reduce costs and shorten the construction period. Members of a cross-sectional team put their heads together to work out the design, etc., but what proved most effective were clever improvements to the burners themselves. The incinerator uses two burners: a main burner used at startup only and a gun burner employed for constant use (Fig. 1). Originally, conversion to natural gas was intended for both types of burners; however, since the Chubu Sewage Treatment Center runs almost constantly, it was

suggested that kerosene be used for the main burner, which is used during startup only. In other words, the incinerator would feature “hybrid burners” using both kerosene and natural gas. This helped to compress the volume of construction work, and thus made it possible to meet the Hamamatsu municipal government’s requests for cost reduction and a shorter construction period. This idea also involved technical issues, such as fulfilling gas supply conditions, checking whether legal regulations on the burners to be used would be applied to the circulating fluidized bed incinerator, selecting burners in accordance with gas pressure, and checking the usage characteristics of the burners and incinerator. As they managed to resolve these issues one by one, they hit upon the idea of installing a natural gas supply facility while still keeping the kerosene-powered burner. However, those who were involved in the operation of the facility did not unanimously welcome each and every one of Kubota’s proposals and ideas. Apparently, some had concerns stemming from the fact that such an attempt had never been made before. It goes without saying that it is essential for sewage sludge incinerators to operate stably.

“The worst nightmare of anyone involved in the operation of such a facility is incinerator shutdown. We could not deny the possibility of suspension of operations due to fuel conversion work being extended,

Masaki Saito, Director,
Sewerage Facilities Division,
Water Services Department, Hamamatsu City



Hideyuki Tsuboi, Assistant Director,
Sewerage Construction Division,
Water Services Department, Hamamatsu City

Electric vehicle (EV) used by government officials
(at Hamamatsu City Hall)



Hamamatsu City Seibu Waste Incineration Plant – a portion of the dewatered sludge is co-combusted with garbage in the waste incineration plant's combustion/melting furnace to create sand-like slag (bottom photo) that can be used as a material for asphalt.



A distant view of the Sea of Enshu as seen from the central Hamamatsu City

which would result in irreparable consequences. Even if the construction work was to be completed as scheduled and operations began, I must admit that those involved in the facility had no small amount of anxiety as to whether the incinerator would really run without a hitch.” (Masaki Saito, Director, Sewerage Facilities Division, Water Service Department, Hamamatsu City)

Cutting costs, shortening the construction period, and offering solutions to technical issues were certainly all important, but what was equally or even more essential to making the fuel changeover a reality was gaining the understanding and consent of people working at the facility. Such being the case, the closest attention was paid to ensuring a complete understanding among those concerned by providing the most detailed explanations of the facility renewal plan and Kubota's approach, while at the same time presenting them with the overall process, which was meant to eliminate any unnecessary risks by securing an extended trial run period before the facility would become fully operational. The proposed process was also designed to minimize the incinerator's shutdown period. During the some six months of construction, the incinerator was suspended for only twenty days. This was made possible by simulating the construction work in order to eliminate any loss and proceed with the work in the most efficient way possible.

“I was most impressed by the enthusiasm displayed by Kubota's engineers. We were admittedly a bit nervous about the order, as it was the very first project of its

kind. They listened earnestly to any concerns that we had. Thanks to their accurate understanding of our needs and quick responses, we were able to achieve this fuel conversion. We believe that being able to use both kerosene and natural gas is not only cost efficient, but also highly effective in hedging potential risks involved in natural disasters and other catastrophes.” (Hideyuki Tsuboi, Assistant Director, Sewerage Construction Division, Water Services Department, Hamamatsu City)

In August 2009, the renovated sewage sludge incinerator resumed operations, and the fuel conversion certainly did achieve a significant reduction in CO₂ emissions. In FY2009, CO₂ emissions from the incinerator were reduced by 39.38% compared to FY2005 levels. As a result, emissions from the Chubu Sewage Treatment Water Purification Center also declined overall by 21.17%, thus contributing significantly to “Operation CO₂ · CO₂ Diet.”

Renewable Energy Supplied from Sewage Treatment Plants

Hamamatsu City's project to combat global warming has by now expanded to include all sorts of programs, such as the introduction of new energy equipment to its public facilities, use of low-emission vehicles (hybrid cars, natural gas cars, etc.) as official city vehicles, subsidies for home-use photovoltaic power generation systems, etc., opening of the Hamamatsu City eco model house, and widespread utilization of biomass

(organic resources made from forest resources, raw garbage, scrap wood from construction sites, etc., which are in plentiful supply). Meanwhile, its sewage sludge incinerator has no small amount of inherent issues, and these are not unique to Hamamatsu City, but are shared by every sewage sludge treatment plant in Japan. One of these issues involves recycling. Incinerated ash generated by burning sewage sludge is recycled into cement and other construction materials, and its recycling ratio has reached approximately 77% (FY2007 national average). However, the sustainability of recycling such incinerated ash into raw materials for cement – currently the most prevalent use of such recycled materials – is not without its concerns, since cement companies do not always take them, as cement demands fluctuate with the economy. Making aggregate concrete or bricks, on the other hand, can incur a large amount of costs, and so demand has yet to become stabilized. Going forward, it will be necessary to diversify and expand recycling applications, including, for example, using such materials as compost for green farms.

Another pioneering initiative is also under way, albeit slowly, through sewage treatment plants including sewage sludge incinerators that are used as a base for collecting energy generated from urban activities, which are then recycled into resources and energy and distributed from those facilities. They use methane fermentation of sewage sludge to generate biogases (biological energy resources), which are then used as fuel for gas electric power generation. Much is expected

from this sewage gas generation, which is currently carried out at more than 20 treatment plants across the country including Tokyo and Yokohama City. Also, plans are underway to use dewatered sludge that is dried and carbonized into solids as a coal alternative at thermal power plants. Other ongoing initiatives include the use of heat generated by sewage itself, small-scale hydroelectric generation utilizing sewer systems, photovoltaic power generation and wind power generation in the vast space available on the premises of sewage treatment plants. Viewed in a new light as a supply center of renewable energy, sewage treatment plants have the potential to contribute significantly to the prevention of global warming and realization of a recycling, low-carbon society.

At Hamamatsu City, “preparations are being made so that action can be taken at any time.” (Motoi Nasu) Originally created for the purification of wastewater, sewage treatment plants are now required to reduce their CO₂ emissions as the cry for such reductions becomes increasingly heard. Hamamatsu City's CO₂ emissions reduction through use of a “circulating fluidized bed incinerators” and “fuel conversion” represent a successful example in this regard. This is not the end of their journey, however. Hamamatsu and other local governments will accelerate their drive to prevent global warming through new approaches by shedding new light on sewage system facilities in their entirety, as they continue to broaden their perspective even further.

“100-Year” Durability – Our Benchmark

—“GENEX” Next-generation Earthquake-resistant Ductile Iron Pipe

As of late, the coverage of water services in Japan has exceeded 97%. Waterworks are definitely essential infrastructures that one cannot do without. However, many of the water pipelines laid during the period of high economic growth have by now become obsolete and need to be replaced. On this occasion, earthquake resistance, reduced replacement costs, and longer service life are required of such new water pipelines. In autumn of 2010, Kubota's next-generation earthquake-resistant pipe for water pipelines, GENEX, was released into the market. This is a product brought into reality from the time-honored “DNA” carried on by Kubota's iron pipe engineers.

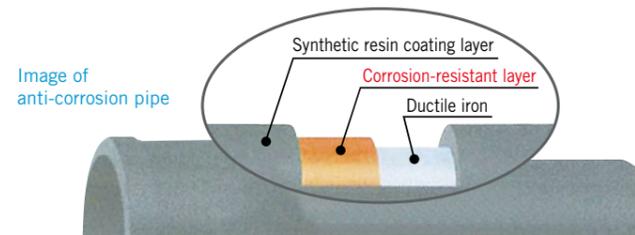
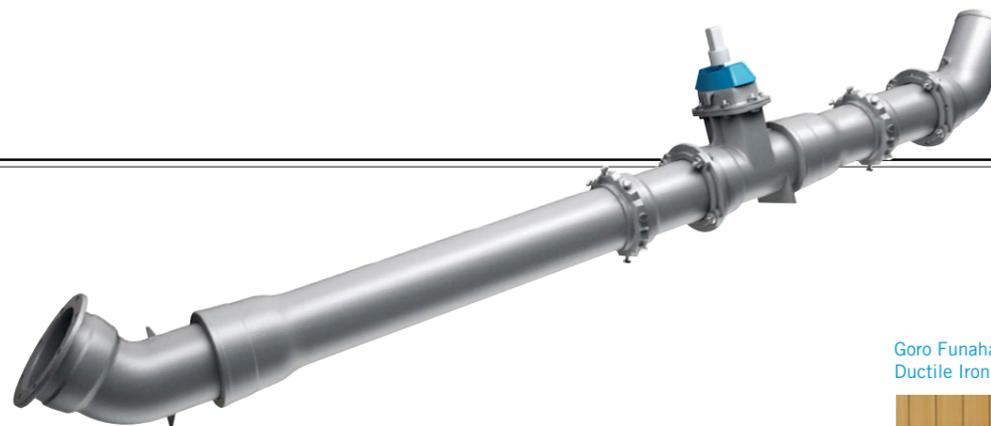


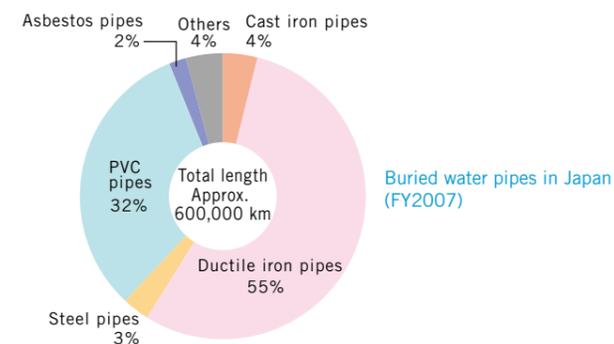
Image of anti-corrosion pipe
Pipe corrosion resistance has been enhanced by the adjustment of components used in the corrosion-resistant layer

Goro Funahashi, Manager, Group 1, Ductile Iron Pipe R&D Department



“It was indeed extremely challenging to pursue an optimal alloy composition for anti-corrosion performance and to process such an alloy into a wire rod for spraying. We did not have any know-how but worked up the courage to take on the challenge, and we eventually made it. After that, development took great strides forward.”

Touring a test installation site in Tokyo. GENEX's high installability was met with an enthusiastic response from industry visitors.



Shozo Kishi, Manager, Group 2, Ductile Iron Pipe R&D Department



“The biggest point in the development of joint structure for pipes was to achieve reduced insertion force while securing water-tightness. The ‘twin bulb’ structure for rubber gaskets made it possible to reduce the insertion force to one third of that for the conventional one.”

Pipes can be joined with one lever hoist, even in a trench as narrow as 50 cm wide. This compresses costs and reduces operators' workload.

Lower Costs and Easier Installation Toward a Longer Life Exceeding 100 Years

The development concepts of Kubota's next-generation ductile iron pipe GENEX was crystal clear from the very outset: reduced costs for laying pipelines, significantly improved installability, and longer service life.

To promote the replacement of water pipes across the country with earthquake-resistant joints, reducing pipeline laying costs is the first thing that must be considered. Civil costs, which account for roughly 40% of total pipe installation costs, can be reduced greatly if the width of excavation trenches can be narrowed down. To achieve this, Kubota developed joint structure for GENEX, making it possible for the pipes to be jointed with low insertion force. As a result, it is possible for pipes to be jointed in a narrow trench by manipulating one lever hoist on the pipe. At the same time, reduced insertion force also helped to significantly enhance installability and shorten the construction period. While maintaining superior earthquake-resistance and water-tightness, total costs were lowered to the level of what would be incurred when laying ordinary joint pipes.

To achieve “longer service life,” Kubota set for itself the goal of making earthquake-resistant pipes that can endure for 100 years. The most common corrosion prevention method now involves laying a 0.2 mm-thick polyethylene tube over the entire length of ductile iron pipe at the construction site. Due to concerns about deterioration when the tube is damaged, however, it was desired that anti-corrosive performance should be enhanced by the ductile iron pipes themselves. As such, Kubota decided to pursue an original approach to form an anti-corrosion coating on the external surface of the ductile iron. It is common practice to form this type of coating by spraying zinc. However, Kubota added its own original blend of tin and magnesium to zinc to generate the coating that provides superior corrosion resistance. Furthermore, by using inorganic particles to seal tiny pores in a coating that cause corrosion, it became possible to extend the duration of corrosion prevention by a large margin. As a result, in ordinary

soil conditions (95% of Japan's land, excluding mountainous areas), GENEX's anti-corrosion coatings may last for more than 70 years, and iron portions for more than 30 years, making the expected life of a GENEX pipe more than 100 years.

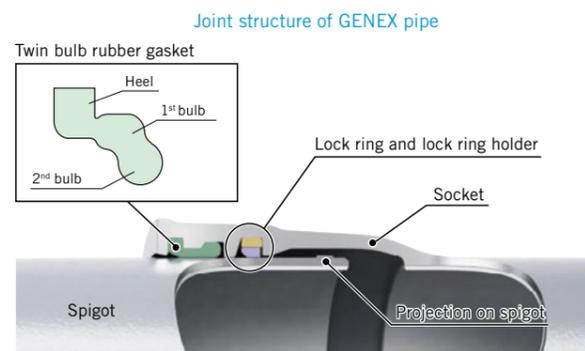
GENEX, the Best Choice for Japan's Water Pipelines, Underpins a Safe and Care-free Living Environment in Japan

As described thus far, Kubota's next-generation earthquake-resistant ductile iron pipe GENEX achieves lower costs, higher installability, and longer life, while at the same time offering superior earthquake-resistance. It is no exaggeration to say that its debut had been long hoped for now that the majority of water pipelines in Japan have entered their replacement periods. Another noteworthy point concerning these characteristics is the fact that GENEX greatly contributes to the reduction of environmental impact by conserving resources and reducing carbon emissions. In October 2010, in recognition of its superb performance and quality, the JCPA made GENEX a standard product for the industry (new earthquake-resistant pipe [GX type]). For Kubota, GENEX has turned over a new page in its history of ductile iron pipe development. It is certain that this offering from Kubota will strongly support a safe, care-free living environment into the future, and Kubota will remain committed to taking on new challenges, such as expansion of its product lineup to include large-diameter pipes, enhancement of pipeline renewal technology, and development of new materials.

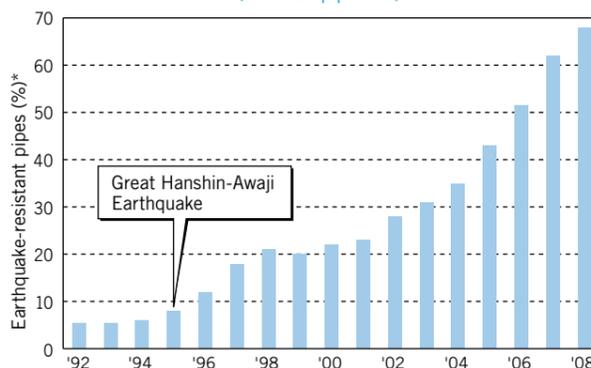
The 21st century has been referred to as “the century of water,” and it is estimated that about two thirds of the global population will experience water shortages by 2025. The water pipeline technology that Kubota has been developing since its foundation, including that of GENEX, will continue to offer significant contributions to the upgrading and improvement of waterworks around the world.

“Ductile Iron Pipes” Support Water Pipelines in Earthquake-prone Japan

The total length of water pipelines installed underground across Japanese territory is approximately 600,000 km, and approximately 330,000 km, or 55%, is made up of ductile iron pipes. Highly strong yet elastic ductile iron pipes have high earthquake-resistant performance thanks to their flexible joints in responding to ground deformation, as well as superior corrosion resistance. Having acquired the basic patent for ductile cast iron, which was invented in the United States, Kubota became the first company in Japan to supply ductile iron pipes in 1954. As the demands for development of earthquake-resistant water pipelines surged in the wake of the 1964 Niigata Earthquake and 1968 Tokachi-Oki Earthquake, Kubota developed earthquake-resistant joints. In the Great Hanshin-Awaji Earthquake in 1995, there were no leakages or breakages over the roughly 270 km of Kubota's ductile iron pipes with earthquake-resistant joints buried within Kobe City. With their outstanding earthquake resistance proved in that unprecedented great earthquake, the pipes are now widely used throughout the country as one of the most effective countermeasure against earthquakes. Meanwhile, to enhance water quality levels, Kubota developed internally fusion-bonded epoxy coated pipes that have superior water quality. It has been demonstrated that the coating condition can remain sound for over 20 years. GENEX is an advanced ductile iron pipe that combines superior performance for the next-generation.



Supply of ductile iron pipes with earthquake-resistant joints (for water pipelines)



*Percentage of the weight of earthquake-resistant pipes to that of all pipes (Japan Ductile Iron Pipe Association <JCPA >)

Humans Now Have an Urgent Decision and Resolution to Make

With a Clear Recognition of the Situation, We Must Make a Paradigm Shift of Values to Protect this Planet from the Catastrophes Resulting from “Global Warming!”



From Industrialized Civilization to Eco Civilization Pursuing a Sweeping Environmental Energy Revolution!

Growing concerns over global warming led the world to hold the 1992 Earth Summit in Rio de Janeiro, Brazil, where the Global Warming Convention was adopted. Twenty years later, despite continued efforts to create a sustainable society, the world is now required to raise the bar much higher. To move from industrial civilization to eco civilization, we must be determined to make radical shifts in our values and to change our perceptions.

The universe came into existence some 13.7 billion years ago, Planet Earth appeared roughly 4.6 billion years ago, and the first life was born on this planet about 3.8 billion years ago. Planet Earth has since given birth to over 30 million species of organisms – and each one of them is a precious treasure. Throughout the 3.8 billion year history of terrestrial life, this planet has experienced the formation of supercontinents four times, mass extinction five times, and Snowball Earth (where the Earth was completely frozen) twice. The planet's life forms survived this harsh and lengthy extent of time. We must never let them become extinct due to



Ryoichi Yamamoto

Chairman, International Green Purchasing Network (IGPN)
Professor Emeritus, University of Tokyo

Profile

Currently holding the position of Chair of the International Green Purchasing Network (IGPN), Dr. Ryoichi Yamamoto has a Ph.D. in Engineering and serves as Professor Emeritus at the University of Tokyo. A graduate of the University of Tokyo Faculty of Engineering's Department of Metallurgy, he was formerly Professor at the University of Tokyo Institute of Industrial Science. His areas of expertise include materials engineering, theory on the development of sustainable products, and eco design. He concurrently holds (and has held) many important posts, including Science Advisor at the Ministry of Education, Culture, Sports, Science and Technology (2004-2007), Honorary Chairman of the Research Group of Ecological Materials, President of the Life Cycle Assessment Society of Japan (JLCA), President of the Sustainable Management Forum of Japan, President of the Eco-Efficient Forum of Japan, and Chairman of the Eco-Products Exhibition Executive Committee. His selected literary works include *Eco-material Revolution to Save the Planet Earth*, *Strategic Design of Sustainable Management*, *Sustainable Companies*, *Global Warming Hell*, and *The Time We Have Left*. He is also the responsible editor of *One-second World*, *How to Spend Money to Change the World*, and *Climate Change +2°C*.

global warming in such a short span of 100 to 200 years. To this end, the first thing that we must do is to have the firm willpower to protect this planet and its lives. Secondly, we must have a strong recognition that this planet is now faced with a formidable crisis.

In 2009, the global community agreed to limit the rise in global surface temperature to two degrees Celsius compared to what it was before the Industrial Revolution (2°C Climate Target^{*1}). Toward this end, climate scientists estimate that no more than 750 billion tons of greenhouse gases (CO₂ equivalent) may be emitted collectively by the world's countries if there is to be a 67% chance of the 2-degree goal being met. If this amount is divided by 6.9 billion – the current global population – the per capita amount is 108 tons. Assuming that the volume of annual emissions per capita in Japan is approximately 10 tons, our emissions will exceed this amount within about 11 years, which means that we may have to completely do without fossil fuels after that. As this estimate shows, any eco energy revolution that aims to observe the 2°C Climate Target will have to be thorough and drastic. We do not have much time left. Signs of the catastrophes due to “global warming” have already surfaced: there have been reports on all sorts of extraordinary events, including the collapse of gigantic ice shelves in Greenland, the decrease of ice in the Arctic Ocean, great floods in Australia, heat waves in Russia, and intense heat and tremendous snowfall in Japan, to name but a few. And each and every one of these problems is directly

connected to food and water issues. Combined with the growing global population, shortages of food caused by poor crops due to unusual weather can trigger food-related conflicts. An international conference has already been convened – although this is not well-known in Japan – to discuss what should be done about farming when the average temperature of this planet has increased by 4°C. Furthermore, repeated droughts and floods around the world can cause the supply and demand of water resources to become significantly unbalanced. There is also a concern of conflicts over water resources, whose access is limited in the same way as food. The prerequisite for a solution to these problems is the fight against global warming, and urgent and thoroughgoing efforts are needed now more than ever.

*1 2°C Climate Target

At the July 2009 G8 L'Aquila Summit in Italy, it was agreed to limit the rise of the world's average temperature by 2°C compared to what it was before the Industrial Revolution. Atmospheric carbon dioxide (CO₂) concentration had in the past tended to shift periodically between 180 ppm and 300 ppm (ppm is the most common expression of concentration. 1 ppm equals 0.0001% and 10,000 ppm equals 1%.) during the Earth's glacial and interglacial cycles, but has now reached 380 ppm due to human activities. Scientists say that the climate system of this planet is sensitive to CO₂ concentration, and recent research has predicted that critical climate changes can occur when it reaches 450 ppm, or when the global average temperature has risen by 2°C compared to pre-industrial levels.



From Carbon Neutral to Carbon Negative What We Need is an Essential Change of Values

It goes without saying that the path to avert catastrophes on Planet Earth resulting from global warming involves curbing greenhouse gas emissions. The global community has set forth a clear roadmap to achieve such a goal: reduce greenhouse gas emissions sharply after the predicted peak in 2015, and then to 50% compared to 1990 levels by 2050, further down to 80% by the end of the 21st century, and eventually to zero in the 22nd century. If we take a closer look at greenhouse gases, however, CO₂ is the most problematic. Some scientists have reported that around 25% of CO₂ discharge into the atmosphere will remain in the atmosphere for thousands or even several tens of thousands of years. That is to say that, even if we successfully reduce CO₂ emissions to zero, global warming will continue to advance due to the residual CO₂ in the atmosphere. Because of this, it is urgently required that programs be designed that not only aim to be “carbon neutral,” i.e., reducing CO₂ emissions to zero, but to be “carbon negative,” i.e., reducing existing CO₂ in the atmosphere by collecting it. And the world has both the technology and the funds needed to realize this goal. However, a stumbling block in the thoroughgoing combat against global warming is

“humanity’s desire” for its vested interests and affluence through economic growth. As such, any initiative to protect Planet Earth and the lives of humankind and other species will inevitably demand an essential shift of values, which will often involve philosophical and ethical connotations. It is thus quite important that, through “penitence and conversion,” humans develop a correct realization that this planet is currently in a state of desperate crisis.

Viewed pessimistically, there is no small chance of catastrophes breaking out due to the state of climate emergency within the coming 10 years. One way to prevent such an occurrence that is being considered in Europe and the United States is “geoengineering.” The concept involves cooling the surface temperature of the planet by reflecting solar radiation back into space, for example, through the annual injection of 1.5 million tons of sulfur dioxide gas into the stratosphere. It is estimated that this will help to lower the surface temperature by approximately 3°C. However, it is projected that if this remedy were to be implemented, blue or starry skies would no longer be visible, significantly lowering the volume of photovoltaic power generated and exerting a profound influence on farm products. How aware are the Japanese of the gravity of the situation, when this kind of “emergency” plan is being openly discussed to combat global warming?

From Relatively Sustainable Management to Absolutely Sustainable Management Drastic Decisions Based on the Lofty Environmental Philosophy Required from Leaders

Against this backdrop, businesses will have no choice but to put into practice “sustainable management,” namely, changing their mold while sustaining business management. Achievement of sustainable growth requires that “eco-efficiency” be increased by maximizing corporate value while minimizing the impact that business undertakings have on the environment. So far, previous attempts in this regard have had to do with relatively sustainable management, but “absolute” efforts will be required from now on. To put it simply, it is essential to achieve absolute reduction of CO₂ emissions. We must leave behind such halfhearted strategies like “developing eco-friendly products,” when the survival of life itself is at risk. It is totally meaningless to publicly brag about how much CO₂ emissions you have reduced. Rather, we need to realize that emitting CO₂ is a “crime” on a global scale. Building on this awareness, businesses are urged to devise ways to transform their operations from “carbon neutral” to “carbon negative.” From relatively sustainable management to absolutely sustainable management – this is a moral obligation of any business manager in the 21st century. In a sense, it could be compared to the practice of religious beliefs.

And it is nothing less than the leadership of top management that is most necessary to realize absolutely sustainable management, with leaders guiding their employees with high aspirations and lofty environmental philosophy. It is now the time when leaders are expected to make daring decisions. Once there was a top manager of a manufacturing company who announced that his company would completely discontinue using CFCs – the main cause of ozone layer depletion – within two years, without having any specific alternative technology in mind. In response, his employees began developing alternative technology, and a new technology was established before the two-year limit had been reached. This is an excellent example that shows how the situation can be changed if a leader makes a firm decision.

Planet Earth has begun to bear its fangs. We should never assume that nature is always kind to us. Within the next 10 to 20 years this planet will go through a period of phenomenal crisis full of Sturm und Drang. Amid this environment, businesses and economic circles are urged to create new innovations with an unyielding determination in order to establish a new paradigm and rules for what may be referred to as a “21st century model economy.” And yes, it is time now for us to take the plunge and cross the Rubicon once and for all.

Living on Planet Earth

Some 3.8 billion years ago, the first life was born on Planet Earth, which had by then become a rare planet with vast expanses of oceans and an atmosphere. The organism then began to “live” as it drifted about in the sea. Perhaps it was the exercise of strong will brought about by the providence of life. Ever since that time, a great many species have been born and gone extinct, but our ancestors survived through the process of evolution, and over 30 million different species of all kinds have come to prosper on this planet. And now...

The global environment is expected to face a serious crisis brought about by global warming and resultant climate changes. However, it is not the planet itself, but humankind that will eventually go on to sorrowfully cry out for help...

We must be awakened to the hard fact that it is we humans who hold the key to the future destiny of our own species and the other diverse organisms inhabiting our planet.

Living on Planet Earth – the strong will and determination to do so is needed now more than ever.

