



SANITATION AND SUSTAINABLE DEVELOPMENT IN JAPAN

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ABBREVIATIONS

BOD	biochemical oxygen demand
CO ₂	carbon dioxide
FY	fiscal year
¥	Japan yen
JSC	Japan Sanitation Consortium
MLIT	Ministry of Land, Infrastructure, Transport and Tourism
MOE	Ministry of the Environment
O&M	operation and maintenance
PAWTP	packaged aerated wastewater treatment plant
SKS	Kobelco Eco-Solutions
WWTP	wastewater treatment plant

Weights and Measures

m ³	cubic meter
m ³ /day	cubic meter per day
m ³ /month	cubic meter per month
km	kilometer
km ²	square kilometer
mg/l	milligram per liter

INTRODUCTION

Sanitation has long been “beneath the radar” on the development agendas of governments worldwide. Aside from the massive investment requirements for putting in place sanitation interventions (both structural and non-structural measures) to benefit the community, the sanitation sector, in general, is unfairly classified as unappealing compared with other infrastructure subsectors such as power generation, transportation, and water supply. Too many governments are driven to achieve economic development and yet invest very little in promoting health and environmental conservation, considering how these two are strongly linked toward a country’s economic well-being.

Experiences from developed countries would attest that achieving universal access and coverage in sanitation for its citizens did not happen overnight. It took decades to reach their current state in sanitation, with a sizable investment infused to realize this lofty goal. Countries who have achieved considerable gains in advancing the sanitation agenda thrived on an enabling environment characterized by (i) enactment of legislative instruments prioritizing sanitation; (ii) a robust regulatory regime; and (iii) establishment of institutional arrangements and coordination mechanisms among stakeholders, where functions and responsibilities are clear-cut and delineated. On the financing side, given the capital-intensive nature of sanitation (sewerage, in particular), governments were initially at the forefront of allocating funds to finance sanitation interventions of varying complexities and scale. Toward the later years, the shift toward other forms of financing arrangements came into fruition, allowing the private sector to take a more active role in financing sewerage and sanitation programs and projects.

Sanitation and Sustainable Development in Japan highlights the country’s experience in achieving universal access and coverage in sanitation. The publication emphasizes government’s role (from the national, down to the local level) as pivotal in laying the groundwork and rallying the public in support of achieving clearly defined sanitation goals. The enactment of relevant policies, guidelines, and legal instruments pertaining to the various aspects of wastewater management (e.g., design standards, regulation, financing, and institutional arrangements) enabled the Japanese government to commit and bolster its resources toward implementing various wastewater management interventions across the country.

Examples from the cities of Kitakyushu, Kobe, Saitama and the town of Tadotsu exemplify a governance framework where the enabling instruments, institutional linkages, and management structures are all meshed up seamlessly toward a common goal of advancing sanitation in the country. Aside from pooling government resources to prioritize sanitation, the framework created enough room for technological innovations (with emphasis on resource recovery) to thrive, partnerships with the private sector established and strengthened, wastewater management operations done in a sustainable manner, and the public to be made aware and engaged as active partners in nation-building.



Source: M. Ebarvia

Enabling Policy and Laws

In Japan, the Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) manages offsite sanitation (sewerage and wastewater management), while the Ministry of the Environment (MOE) handles onsite sanitation (johkasou, septage management with scheduled desludging, sludge treatment facilities). Both ministries are expected to work together.

To properly promote sewerage works subsidized by the national government, the Sewerage Law of Japan stipulates the structural criteria and standards for effluent quality; guidelines for planning, construction, and installation of pretreatment facilities; household connections; user fees; national government financial support; and the respective roles of national and local governments.

In areas where construction of a sewerage system is difficult, the households or small communities, located mostly in rural or peri-urban areas, use the onsite treatment system called *johkasou*.¹ The Johkasou Law mandates the owner to engage a desludging contractor for the facility at least once a year, with the owner paying the associated charge. The effluent water quality of the johkasou is monitored by the authorized inspection agency once a year in accordance with the law.

The Waste Management and Public Cleaning Law mandates local governments to create a Household Wastewater Treatment Plan for their municipalities, including a Sludge Disposal Plan. Sludge treatment facilities are to be constructed, operated, and maintained by municipalities and cities.

Financing mechanism. As part of the sanitation policy of Japan, financing arrangements were established to support the investment and operation and maintenance (O&M) costs. Laws and ordinances also regulate the scope of national subsidies, the procedures for the provision of subsidies, and complete examination of the constructed sewerage facilities. The Sewerage Finance Research Committee conducted several studies and discussions on the rational cost-sharing for sewage works. Following the principle of “stormwater at public burden and wastewater at private burden,” recommendations were made enabling the formulation of plans and implementation of sewage works. About half of the construction cost is financed through national subsidy. The remaining cost is financed mainly through local government bonds, which are repaid through user charges and the general account of local governments. Landowners in areas covered by sewerage systems bear part of the construction cost as a beneficiary payment. For maintenance cost, the stormwater cost is paid with the general account budget of local governments, while the cost for wastewater is paid by user charges.

¹ Johkasou (johka, purification, sou, tank) is a packaged aerated wastewater treatment plant (PAWTP). It is Japan's onsite or small-scale treatment system installed in individual houses, buildings, or a small community for collection and treatment of night soil (flush toilet wastewater) and domestic greywater. It can achieve high effluent quality of 20 milligrams per liter (mg/l) biochemical oxygen demand (BOD). The system is typically found in districts where sewerage systems are unplanned or difficult to construct. Source: Japan Education Center of Environmental Sanitation. 2009. *Johkasou Systems for Domestic Wastewater Treatment*. 4th Edition. Japan.

Sanitation as a business. Under the Local Government Finance Act of Japan, public sewerage systems are managed by public enterprises, but are required to become self-sustaining businesses using a special account separated from the general account. In essence, these enterprises adopt the self-support accounting system wherein costs are covered through the income generated. Transparency is also being practiced by making management information accessible to the citizens, as they are the taxpayers and, at the same time, users who bear the fees and charges. For the maintenance of sewerage systems, it has been noted that there is an increase in the number of cities entering into management contracts. The Private Finance Initiative is adopted in some cases, such as for power generation using digestion gas.

Kitakyushu: River and Coastal Clean Up

The city of Kitakyushu is an industrial city of approximately 1 million people (as of 2013) in western Japan. The city has a long coastal line of 210 kilometers (km) and abundant nature with 40% of the city area covered by forest. The city is also characterized by many heavy industries, such as iron foundries, which are located in the coastal area. This industrial activity caused major environmental issues in the 1950s–1960s with severe air and water pollution. From that time, countermeasures were gradually put in place and Kitakyushu became the first city in Japan to improve its water environment.

Currently, around 99.8% of the population is covered by the public sewerage system, while the remaining population (0.2%) is covered by onsite sanitation systems—mainly by the PAWTP called johkasou in Japan—in areas where sewerage construction is difficult.² The city has five wastewater treatment plants (WWTPs) using the conventional activated sludge process.



Swimming competition in Murasakigawa River.

Source: Kitakyushu Municipal Government, 2012.

² Kitakyushu Municipal Government. <http://www.city.kitakyushu.lg.jp/suidou/04600128.html>

Stakeholder participation. During the period of 1950–1960, improvements made on its water environment were due significantly to a group of women who stood out among those calling for immediate action against the rising problem of pollution. Demands from women’s associations in the city provided the stimulus for the municipal government to establish counter measures. Spontaneously, pollution conditions were assessed. Based on the results, the government administration and businesses became proactive in initiating activities to alleviate the state of the environment. Various citizen groups conducted environmental research, river cleanup campaigns, and collection of cans and bottles thrown along roadsides. These became the catalyst for the introduction of the sewerage system and the redevelopment of riverbanks along the Murasakigawa River. Resettlement of informal settlers along the river was also done with consultations among the affected families.

Technology development. Environmental engineering development by both the public and private sectors was also enhanced due to demand for wastewater treatment. The developed technologies were also supplied outside Japan, resulting in payback for the large investment required for sewerage. Exporting the technologies enabled environmental improvement in other countries as well.

Kobe: Biogas as Fuel for Homes and Vehicles

Kobe City is one of the main cities of the Kansai region (Western Japan) with a population of approximately 1.54 million people as of 2013. In this city, domestic wastewater is treated through the public sewerage system and six WWTPs, which serve 98.7% of the population [over 1.52 million residents as of end of fiscal year (FY) 2013].³ The rest is served by the rural sewerage system (small-scale sewerage system) and PAWTPs (johkasou).



Kobe gas is produced at Higashinada WWTP.

Source: JSC.

³ Hyogo Prefectural Government. 2015. Penetration rate of sewer. Japan. http://web.pref.hyogo.jp/wd18/wd18_000000034.html

Disaster resilient. The sewerage system in Kobe City is characterized by the interconnection of four WWTPs forming a sewer network system that is resilient to disasters. The system is an outcome of the Great Hanshin-Awaji earthquake in 1995.

Climate change mitigation. Kobe also adopted a forward-thinking approach to fight global warming. The city implemented measures to maximize the potential of treating wastewater and sludge as valuable energy resources. Modern WWTPs require high levels of energy consumption. As such, Kobe City has set targets beyond the sanitation goal of public health and quality preservation of water bodies. The Higashinada WWTP concretely demonstrates that it can also be a resource recycling facility. After quality adjustment, Kobe biogas, the by-product of the facility, is not only used inside the WWTP but also as fuel for vehicles and as city gas in the distribution network of Osaka Gas. This project also contributes to the reduction of green house gas emissions. Around 2,700 tons of carbon dioxide (CO₂) per year is reduced because of the methane capture and the effective use of digestion gas.⁴

Saitama City: Sludge for Fertilizer

Saitama is a neighboring city of Tokyo, with a population of approximately 1.26 million people (as of 2014), and relatively high population density. The city combines offsite and onsite sanitation systems. Around 91.5% of its population is connected to the sewerage system, while the remaining 8.5% rely on the johkasou.⁵ Like many other cities in Japan, it is difficult to secure land for sanitary landfills where sludge generated by WWTPs and sludge treatment plants can be disposed. In Saitama City, the sludge generated in the johkasou located within the city boundaries is transported to two sludge treatment plants: the Omiya Purification Center and Nishibori Clean Center.



Residents in Saitama City use treated sludge as compost for gardening.

Source: JSC.

⁴ Data provided by Kobe Municipal Government.

⁵ Saitama Municipal Government. http://www.city.saitama.jp/001/006/003/002/001/p003157_d/fil/pdf1.pdf

Sludge treatment and reuse. The revision of the Central Government's subsidy policy for night soil and/or sludge treatment facilities in 1997 prompted the city to develop a compact system for composting the sludge. As sludge contains phosphate—an indispensable fertilizer element for agriculture and produced in a very limited number of countries—sludge recycling became a more attractive option compared to sludge disposal and incineration. The technology adopted in the Omiya Purification Center is officially certified and widely used throughout Japan. It allows the safe recycling of sludge and composting for use as fertilizer.

Saitama Shintoshin: Wastewater Reuse

In Saitama Prefecture, the use of groundwater is restricted to prevent land subsidence, with more than 70% of the water are drawn from rivers every year.⁶ With increasing demands for water, funding a reliable supply of water is a challenge.

Aiming for the creation of an environmentally-friendly city, the main developers of Saitama Shintoshin (new urban center of Saitama Prefecture, with an area of 47.4 hectares located in the capital of Saitama City) considered rainwater and/or wastewater as an integral component for urban development since the planning stage of the urban center project.

Innovative technology for reuse application. Wastewater from households and commercial establishments in Saitama undergoes secondary treatment at the Saitama Sewage Treatment Center, using conventional activated sludge. To enable wastewater reuse, the treated wastewater is further treated at the Saitama Shintoshin Purification Plant using a combination of biofiltration and ozonation processes.



Separate piping system for water supply and treated wastewater.

Source: JSC.

⁶ Saitama Prefectural Government. Powerpoint presentation. <http://goo.gl/yoxVv>

Water savings. The pipes for the supply of reused wastewater have been installed under the main roads of Saitama Shintoshin, enabling all buildings to be supplied with treated wastewater. About 250,000 cubic meters (m³) of freshwater is saved yearly, amounting to ¥104 million (approximately \$939,000) due to the provision of recycled wastewater.⁷

Tadotsu: Wastewater Treatment for Water Resource Management

Tadotsu is a town in Shikoku Island in Japan, located on the Seto Inland coast. This town is characterized by low rainfall. Consequently, Tadotsu regularly suffered from water shortages and droughts in the past, which put water resources under considerable stress. Securing stable water supply for drinking and irrigation, reducing the risk of droughts, and maintaining water levels in rivers and groundwater always proved difficult. For these reasons, the wastewater reuse was promoted.

Water resource management. Treated wastewater is now being reused for various purposes, such as river restoration; irrigation for agriculture, parks and gardens; ground water recharge; and augmentation of the streams and brooklets running through the town.

Recreational amenities and tourism revenues. The reuse of treated wastewater restored the ecological habitat and improved the natural environment of the town. It allowed the creation of new water amenities (brooklets) and the revitalization of parks. The Wastewater Reuse Project contributed to improving the town's attractiveness and enhancing tourism. It also resulted in a positive economic impact on the associated industries. Moreover, guaranteeing the supply of water for agriculture and the conservation of the natural environment paved the way for the creation of new courses and programs in the curriculum of schools.



A park in Tadotsu Town.

Source: JSC.

⁷ Data provided by the Saitama Shintoshin Purification Plant.

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Sanitation and Sustainable Development in Japan

This publication documents Japan's experience in pursuing sustainable sanitation solutions in the context of economic development. Five case studies illustrate how sound sanitation policies are essential in achieving a nation's growth. Selected projects in Kitakyushu City, Kobe City, Saitama City, Saitama Shintoshin, and Tadotsu Town provide examples of how robust sanitation systems can deliver economic and environmental benefits. Produced by ADB in cooperation with Japan Sanitation Consortium, this publication also documents key policies and laws that enable the integration of sewerage systems and wastewater treatment facilities in development plans. It shares learnings on how the sanitation challenge can be met, not only at the community, but also at the national level.

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