Theme 6. Financial Management: Finance and Tariffs

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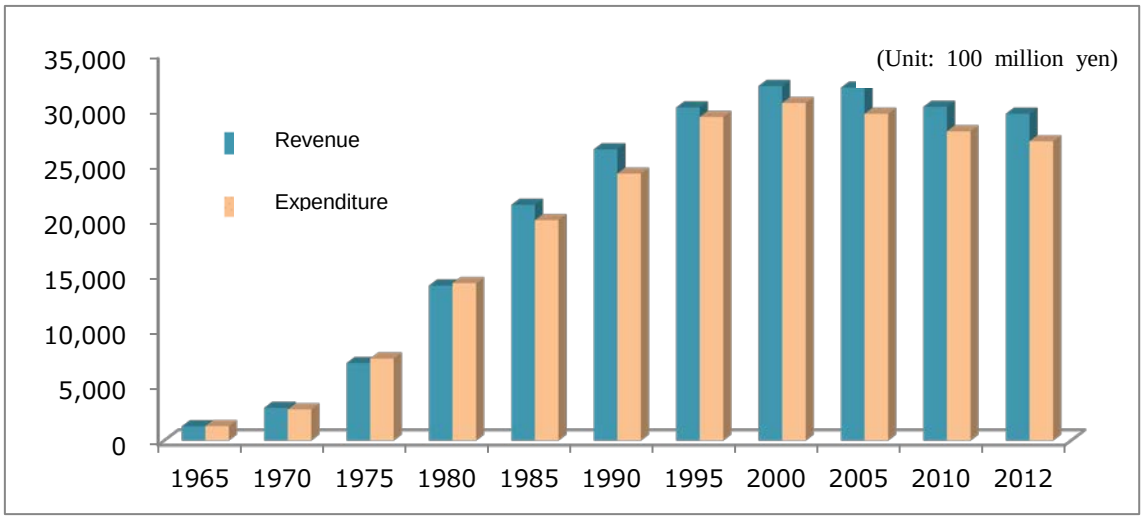
1. Introduction

Up till the 1980s, Japanese water utilities as a whole were running slight budget deficits while they promoted rapid development of the water supply systems (see Figure 1). Since then water tariffs, which are the main source of revenue, cover all expenditures, including interest payments, repayment of long-term loans for facilities construction, operation and maintenance costs, and administrative expenses.



Source: Based on information from JWWA, "*The Outline of Water Supply*," 1st ed. 1986, and 6th ed. 2015.

Figure 1. Change in Total Revenue and Expenditure of Water Utilities in Japan

This module describes the experience of Japanese waterworks management by addressing the following frequently asked questions from participants of the water supply training courses:

Q1. How did Japanese water utilities raise a large amount of funds for water supply development?

Q2. Have Japanese water utilities been able to achieve cost recovery?

Q3. How do Japanese water utilities determine water tariffs? What are the criteria?

Q4. How do Japanese water utilities serve low-income group?

Q5. How do Japanese water utilities achieve almost 100% billing collection?

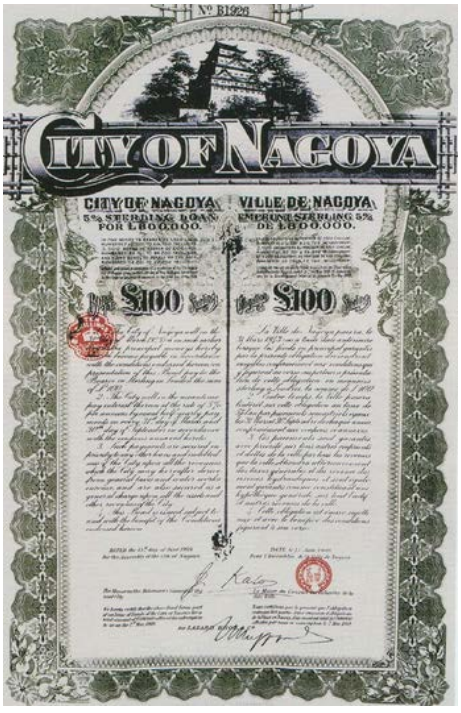
The following sections attempt to provide answers to these questions:

2. Financing Water Supply Development (Q1 and Q2)
3. Setting Water Tariff (Q3)
4. Considerations for Low-Income Group (Q4)
5. Billing and Collection (Q5)

2. Financing Water Supply Development

In Japan, the first modern water supply system was established in Yokohama in 1887. After that, water supply systems were gradually developed in other port cities, major urban centers and provincial towns. Municipal bonds (public enterprise bonds) and government subsidies were main financial sources for the construction of these facilities. Japanese utilities used government subsidies and municipal bonds to finance water supply development projects, and successfully raised the water supply network coverage (population served/total population) from 26.2% in the 1950s to 80% in the 1970s and 90% in the 1980s.

Construction of water supply systems is expensive. Municipal bonds has been normally used to finance these developments. In the early 1900s, Tokyo, Yokohama, Osaka, Kobe, Nagoya and Kyoto issued municipal bonds at overseas markets such as those in London and Paris (Photo 1 and 2) for the development of urban infrastructure including water supply facilities, because it was difficult to raise funds in Japan at that time. Later funding also came from the domestic capital markets. Government subsidies were another important financial resource.



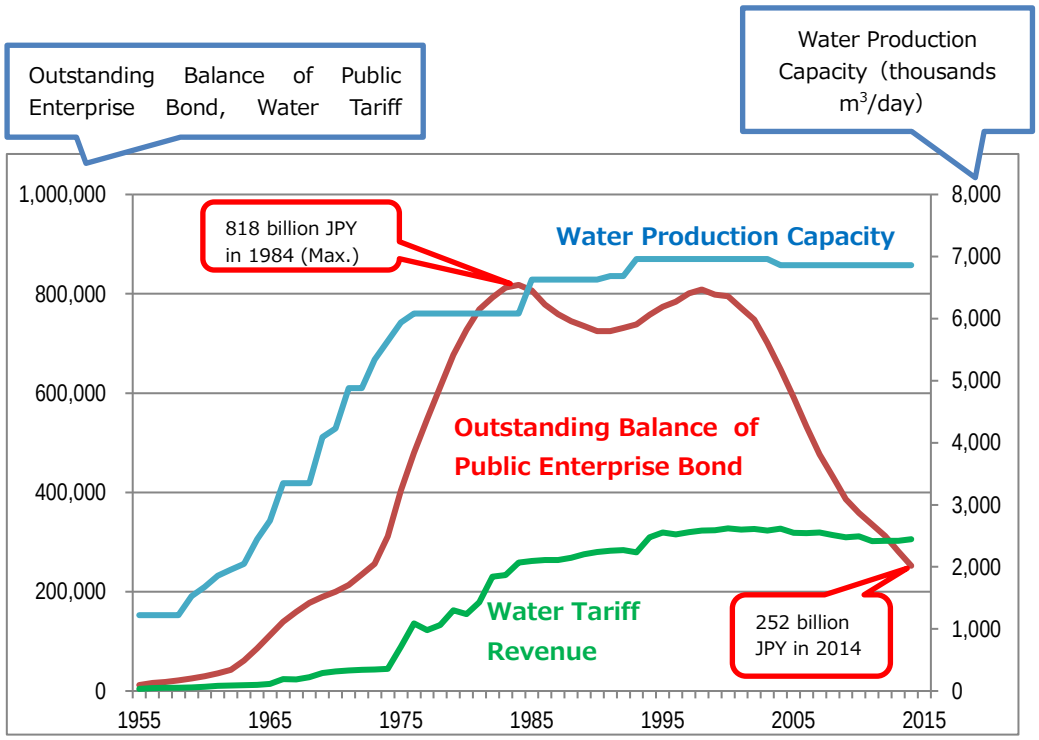
Source: Nagoya City, *"Nagoya City History in Taisho and Showa Period,"* 1955.

Photo 1. Sterling bond issued by Nagoya City in 1909

Source: Kyoto City Waterworks Bureau

Photo 2. French franc bond issued by Kyoto in 1909

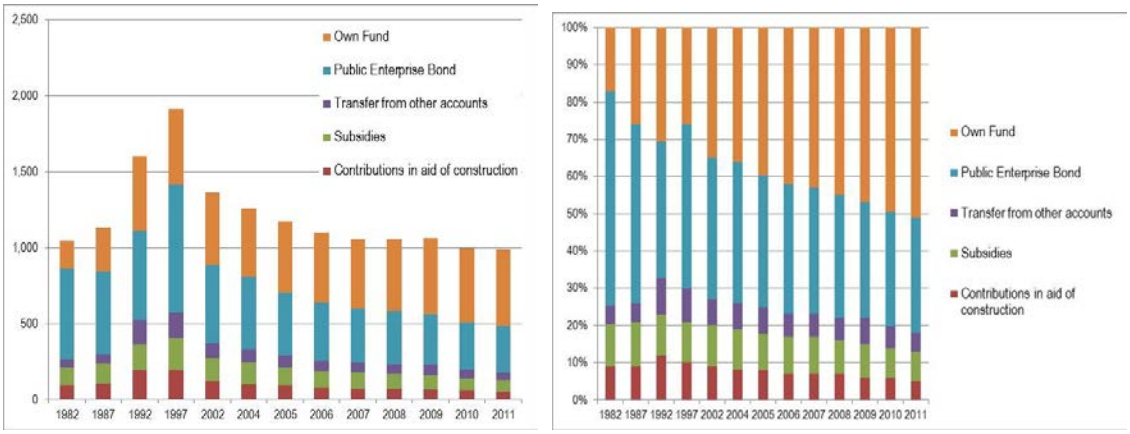
Figure 2 shows the changes in the outstanding balance of public enterprise bonds, principal and interest payment, water tariff revenue and production capacity of the Bureau of Waterworks, Tokyo Metropolitan Government. The outstanding balance of bonds and water tariff revenue increased as facilities were expanded to serve the growing population. The outstanding balance was gradually decreasing after expansion of facilities.



Source: Based on data from Bureau of Waterworks, Tokyo Metropolitan Government, *Annual Report*.

Figure 2. Changes in Outstanding Balance of Public Enterprise Bonds, Water Tariff Revenue and Water Production Capacity of the Bureau of Waterworks, Tokyo Metropolitan Government

By 1960 public enterprise bonds accounted for about 90% of major financial resources for water supply development, but the percentage gradually decreased since then. Investment in the construction of water supply facilities peaked around 1997 and then began to decline, as shown in Figure 3. Funding shifted from reliance on bonds and government subsidies to internal sources, reflecting the transition from construction to operating and maintaining established facilities.



Source: Based on information from Ministry of Internal Affairs and Communications, *Issues on Public Financial Plan: Appendix*, 2013, http://www.soumu.go.jp/main_content/000266902.pdf

Figure 3. Financial Sources for Construction of Water Supply Facilities in Japan
Left: Amounts by Fiscal Years (Billion JPY),
Right: Components of Financial Sources by Fiscal Years

Financed by public enterprise bonds and government subsidies, water supply coverage ratio increased from 26.2% in 1950 to 80% in the 1970s and 91.5% in the 1980s. Other financial sources for facility construction include “transfers from other accounts” and “contributions in aid of construction.” “Transfers from other accounts” are allocations mainly from general accounts to cover part of the repayment of principal and interest on outstanding debts and redemption of bonds issued. This means moving general accounts expenditure to special accounts income. This approach strengthens the foundations of waterworks management and reduces the liability of capital costs. The Ministry of Internal Affairs and Communications (MIC) notifies local governments of “transfer standards” - the rules of expense allocation every fiscal year, and water utilities are required to comply with these rules. “Contributions in aid of construction” refers to payments by developers for extensions of the water supply system to new housing developments, etc.

(1) Municipal Bonds (Public Enterprise Bonds)

Municipal bonds are long-term debt securities issued by local governments. The national government purchased municipal bonds using funds secured through postal savings, national pensions with favorable financial conditions. Proceeds from bond issues were normally used to finance infrastructure needs during periods of high economic growth, such as construction of water supply facilities. The municipal bonds allow the high costs of water supply facilities to be shared equitably over several generations.

Municipal bonds are long-term debt securities issued by local governments. They are repaid over 25 to 30 years. The legal basis for municipal bonds are stipulated in Article 45 of the Water Supply Act (Special Subsidies from the national government) and Article 5 of the Local Government Finance Act (Expenditures for which municipal bonds may be issued).

Municipal bonds issued to finance the construction and improvement of facilities managed by local public enterprises, are called public enterprise bonds[1]. Their principal and interest are basically paid by revenue of the public enterprises. During the period of high economic growth (1955–1973), a huge amount of public enterprise bonds were issued for investments in water supply facilities. Over 70% of the municipal bonds issued in 1964 and 1965 were bought by public funds such as postal savings, employees' pensions, national pensions, and postal life insurance funds. Currently only 40% of bond owners are public entities and the owner of 60% are private entities.

For large major capital projects, utilities normally use long-term debt to spread the cost of the project over the useful life of the facilities to be repaid from future revenue from users of the system. This keeps the annual revenue requirements low and ensures that existing customers are not paying 100% of the initial cost of facilities to be used by future customers.

Water supply facilities have a long service life. The development of these facilities benefits current residents as well as future generations. Therefore, it is reasonable to share the liability of facility construction with future beneficiaries by long-term repayment of the debt over the life of the facilities. This is characteristic not only of municipal bonds, but also of long-term loans from aid agencies or public financial institutions.

The Minister of Internal Affairs and Communications or the prefectural governor must be consulted on municipal bond issues. Projects to be financed must demonstrate engineering and

[1] It is also called as local public enterprise revenue bonds or revenue bonds.

financial feasibility to obtain agreement or permission to proceed. The involvement of higher level government guarantees the financial resources for bond redemption and eliminates the need for assessing the local governments' financial soundness and simplifies the issuance process. Utilities are deemed creditworthy being public institutions that have sound fiscal management and operate on self-supporting accounting system.

(2) Subsidies for Urban Water Supply Developments

Subsidies for urban water supply were provided to increase access to safe drinking water in Japan from 1988 to 1954. They were abolished when the water coverage ratio reached 50%. The subsidy system was restored to achieve specific policies such as water resources development in response to rapid water demand during periods of high economic growth (from late 1960s to 1970s), and has been utilized since then.

Although water utilities in Japan strive for cost recovery, subsidies are needed to promote water supply development as shown in Table 1. When using subsidies, the national government sets clear targets and invests according to well defined policy goals such as increasing access to safe drinking water and securing water resources.

At first, the national government granted subsidies only to three prefectures (Tokyo, Osaka, and Kyoto) and five port cities (Hakodate, Yokohama, Niigata, Kobe and Nagasaki) to cover one-third of the construction costs of water supply facilities. The big cities received the subsidies which covered one-fourth of their construction costs. Subsidies also paid for postwar reconstruction of water supply facilities. These subsidies for urban water supply developments were abolished in 1954. When the water supply coverage reached about 50%, urban centers were expected to finance further expansion by issuing public enterprise bonds, and assistance was directed to Small Scale Public Water Supply serving populations of 101 to 5,000.

The subsidy system was restored in 1967 when water demand increased rapidly because of the surge in urbanization, together with increasing concentration of industries in urban centers. Furthermore, the cost of water supply services increased with the need to pursue new water sources in remote areas because urban water resources were contaminated. The decision was made to use subsidies to develop water resources and consolidate facilities.

Table 1. Historical Changes in Subsidy System for Urban Water Supply Facilities

Period	Target	Rate of grant	Purpose
1888~ 1900~	Three prefectures (Tokyo, Osaka, and Kyoto), and five port cities (Hakodate, Yokohama, Niigata, Kobe, and Nagasaki) Others	1/3 1/4	Improve public health and reduce infectious diseases in major cities and port cities.
1907～	All major cities	1/4	Increase access to piped water.
After World War II ～1954			Post war reconstruction.
1954～1966	Abolishment of subsidies for urban water supply	When the urban water supply coverage reached 50%, subsidies were abolished. Municipal bonds were used to finance the expansion of waterworks in urban areas. Government subsidies were shifted to Small Scale Public Water Supply system development in rural areas.	
1967	Restoration of subsidy system for water resources development, facility development, and for consolidation of water utilities	1/2 or 1/3, 1/4	The financial liability was growing as utilities responded to complex and rapid changes in social conditions such as increase of water demand caused by concentration of population and industries in urban areas, increased water pollution, and the pursuit of water sources in remote areas. The subsidy system was restored based on the decision that it was not appropriate to have water utilities alone shoulder the increased costs.
1978～2009	Development of laboratories	1/4	Improve water quality testing in small- and medium-scale waterworks.
1988~	Development of advanced water treatment facilities	1/3, 1/4	Solve issues of odor and taste of drinking water associated with increased pollution of suburban rivers.
1990～1996	Rehabilitation of old deteriorated pipelines	1/3, 1/4	Promote rehabilitation and replacement of deteriorated pipelines.
1997	Reinforcement of earthquake preparedness	1/2 or 1/3, 1/4	Develop earthquake resistant pipes and water supply locations during emergencies. (Introduced following the Great Hanshin and Awaji Earthquake)
2010～	Development of automatic monitoring system for water sources	1/4	Improve monitoring system shared by some water utilities for efficient water sources management and reduction of management costs.
* Other than above, there are subsidies related to responses to disasters.			

Source: Based on JWWA, "*History of Water Supply in Japan*," JWWA, 1967.
and other materials by the Ministry of Health, Labour and Welfare (MHLW)

(3) Subsidies for Small Scale Public Water Supply

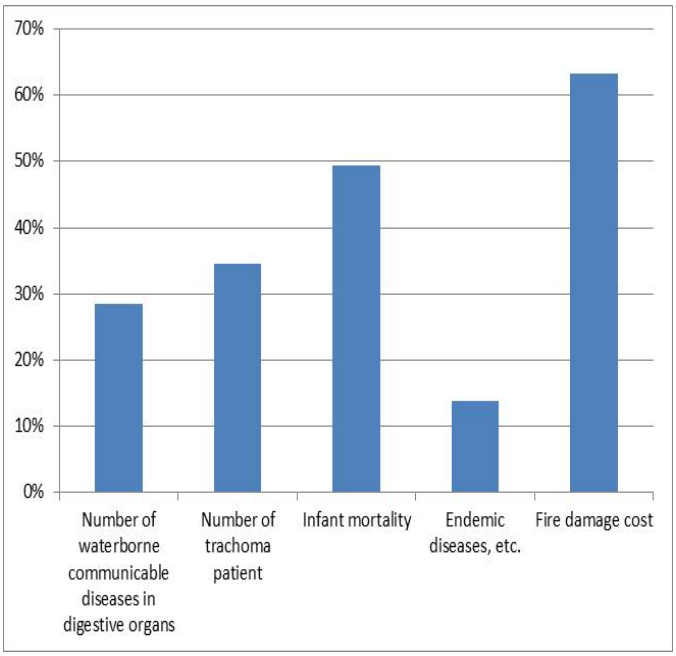
Subsides for the Small Scale Public Water Supply played a significant role in promoting access to piped water in rural areas. The nationwide coverage of water supply service substantially reduced waterborne diseases and infant mortality.

The subsidy system for Small Scale Public Water Supply (serving population between 101 and 5,000, as defined by the Water Supply Act) was established in 1952. The main objectives of the subsidies are to reduce waterborne diseases and relieve women's burden in fetching water for the family.

The Water Supply Division of the Ministry of Health, and Welfare (MHW) [2] persuaded the finance division of MHW to establish the subsidy to improve access to safe water in rural areas, citing the benefits of reduction of disease episodes. The compelling argument was made that the costs of improving water supply would be offset by economic benefits such as a reduction in health care costs.

In 1952 when the subsidy system was established, Small Scale Public Water Supply systems in about 180 areas were newly constructed across the country. After 1952, about 500 new systems were developed every year, resulting in nationwide coverage of water supply services.

In 1957, MHW reported on the outcomes of water supply facilities



Source: The editorial committee of the One Hundred Year History of Modern Water Supply, "*One Hundred Year History of Modern Water Supply*," Nihon Suido Shimbunsha, 1988.

Figure 4. Reduced Incidence of Diseases and Infant Mortality, etc.

(Information presented by the Water Supply Division of MHW in 1957. 100% represents the level that existed before construction.)

[2] The Ministry of Health and Welfare was merged with the Ministry of Labour to form the Ministry of Health, Labour and Welfare in 2001.

development. As shown in Figure 4, the incidence of infectious diseases, infant mortality and damage from fires, were significantly reduced in the 5 years after the promotion of the Small Scale Public Water Supply compared to the 5 year period before. The National Diet discussed the need for waterworks and accelerated water supply development throughout Japan.

Rural population is small. The cost per person for the water supply system is comparatively higher than for large cities. For some projects, rural residents eager to improve living conditions volunteered to work on the construction of facilities and raised funds by selling common forest trees of their community.

Source: Susumu Hani, the film "*Water in Our Life*," 1952

Photo 3. Voluntary Construction Work by Villagers

(4) Private Sector Financing

In Japan, the water supply business used to be financed by municipalities. In recent years, the use of private financing is increasing, supported by relevant laws and guidelines.

The water supply business in Japan is managed by municipalities as stipulated in the Water Supply Act. Recent slow economic growth and fiscal deficits are forcing governments to look for more efficiency and better management of public enterprises. The Act on Promotion of

Private Finance Initiative (PFI Act) was enacted in 1999, to improve public infrastructure through the utilization of private funds, engineering capabilities and management expertise. This approach is based on the belief that the involvement of the private sector would lead to efficient accumulation of social capital and improve delivery of affordable goods and services.

PFI is an approach to improve efficiency in construction, operation, maintenance and management of public infrastructure utilizing private finance, engineering skills and management knowledge. It is regarded as a type of PPP (Public Private Partnership), with the participation of the private sector in the provision of public services.

Private companies are involved in the design, construction, operation and maintenance phases of multi-year undertakings in PFI projects. The process leading to signing such contracts with private companies, are complicated, having to deal with technical, legal and financial aspects for project implementation. MHLW developed the “Guidelines for Introduction of PFI in Water Supply Project” to facilitate this process. Local governments also have been developing their own guidelines.

In utilization of private sector financing, it is necessary to have a strong legal framework and robust regulations to ensure that the public sector has the authority to pursue such projects as well as allow the private sector to mitigate unnecessary risks. It is also important for the parties to “comply with the requirements in the signed contract”. The detailed project plan would lay out the allocation of benefits and risks.

Table 2. PFI Projects for Water Treatment Plants

No	Place (Name of Prefecture)	Contracting Authority	Contract Year (FY)	Contract Type	Target Facility
1	Tokyo	Bureau of Waterworks, Tokyo Metropolitan Government	1999	BOO: Build Own Operate	New power generation facilities for Kanamachi Water Treatment Plant (1,600,000 m^3/day)
2	Tokyo	Bureau of Waterworks, Tokyo Metropolitan Government	2001	BOO: Build Own Operate	New facilities for power generation, chemical feeding, sludge treatment for Asaka Water Treatment Plant and Misono Water Treatment Plant (total capacity 2,000,000 m^3/day)
3	Kanagawa	Enterprise department Kanagawa Prefecture	2003	BTO: Build Transfer and Operate	Renewal of a sludge treatment facility for Samukawa Water Treatment Plant (750,000m^3/day)
4	Saitama	Enterprise department Saitama Prefecture	2004	BTO: Build Transfer and Operate	Renewal of facilities for power generation and sludge treatment for Okubo Water Treatment Plant (1,300,000m^3/day)
5	Chiba	Waterworks Bureau Chiba Prefecture	2004	BTO: Build Transfer and Operate	New sludge treatment facility for Nogikunosato Water Treatment Plant (60,000m^3/day)
6	Aichi	Enterprise department, Aichi Prefecture	2005	BTO: Build Transfer and Operate	Renewal of sludge treatment facilities for four water treatment plants (total capacity 664,000m^3/day)
7	Kanagawa	Yokohama City	2008	BTO: Build Transfer and Operate	Renewal of Kawai Water Treatment Plant (171,000m^3/day)
8	Chiba	Waterworks Bureau Chiba Prefecture	2009	BTO: Build Transfer and Operate	Renewal of a sludge treatment facility for Hokuso Water Treatment Plant (127,000 m^3/day)
9	Hokkaido	Yubari City	2010	BTO: Build Transfer and Operate	Renewal of two water treatment plants (total capacity 7,200 m^3/day)
10	Aichi	Enterprise department Aichi Prefecture	2010	BTO: Build Transfer and Operate	Renewal of sludge treatment facilities for six water treatment plants (total capacity 1,005,400 m^3/day)
11	Aichi	Okazaki City	2012	BTM: Build Transfer Maintenance	Renewal of a rapid sand filtration facility in Otogawa Water Treatment Plant (68,395m^3/day)

Source: JWWA, *Leading Cases of PFI*, http://www.jwwa.or.jp/wide-ppp/coop/coop_case/coop_pfi/

3. Water Tariff Setting

Water tariffs in Japan are decided based on financial, economic and environmental criteria deliberated by local assemblies. Water is essential to life, careful discussions are required when considering tariff increases. In Japan, tariffs are set based on the conditions defined by the legal framework including the Water Supply Act: (1) utilities must maintain financial discipline, using fully distributed cost method and self-supporting accounting system; (2) charges must be fair and simple to understand for the customers; (3) utilities must have efficient management and make continuous efforts to rationalize their operations (e.g. streamlining operations, effective allocation of the fixed number of employees, cost reduction associated with outsourcing, successful collection of unpaid water bills, good asset management, and reduction of non-revenue water); (4) affordability especially for low-income households while ensuring that they have access to an amount of safe water supply considered minimal for residential sanitary requirements; and (5) proper information disclosure to obtain the understanding and support of the citizens, and always emphasize good public relations and customer service. Furthermore, the *Water Tariff Setting Manual* is playing a significant role.

(1) Self-Supporting Accounting System and Fully Distributed Cost Method

The water supply business in Japan is managed on the principle of user-pay and cost recovery using the self-supporting accounting system. The public enterprise accounting system allows the accounting for depreciation costs and calculation of tariffs based on the fully distributed cost method.

The water supply business is managed by revenue from water tariffs using the self-supporting accounting system and public enterprise accounting system. Utilities finance and maintain all aspects of the water supply system, including replacement of infrastructure, using income generated from fees charged to customers. The accounting system must rely on sound asset management that can properly deal with the value of fixed assets (water supply facilities) and their replacement capital over the long-term. The fully distributed cost method enables proper setting of tariff structure, which leads to systematic investments based on asset management.

At the beginning of modern waterworks in Japan, utilities used to be managed by special accounts which were separate from the general accounts of municipalities, but the accounting system focused mainly on cash flow. It was difficult to understand the actual efficiency and effectiveness of the management. In 1952, when the public enterprise accounting system was

introduced under the Local Public Enterprise Act (See Figure 5), the accounting system switched from cash to accrual basis, and the double-entry bookkeeping method was adopted (See Figure 6). Under this system, the same amounts are entered into debits and credits under the account entries for assets, liabilities, capital, expenses, or revenues. This method has the advantage of allowing simultaneous calculations of assets, profits and losses. Depreciation of an asset is entered as a debit in the income statement and also credited to the Accumulated Depreciation account on the balance sheet until the asset is disposed of. The annual depreciation expense component provides for the recovery of the utility's capital investment over the anticipated useful life of the depreciable assets. The funds from the inclusion of this expense were available for use as a source of capital for replacement, improvement, or expansion of its system.

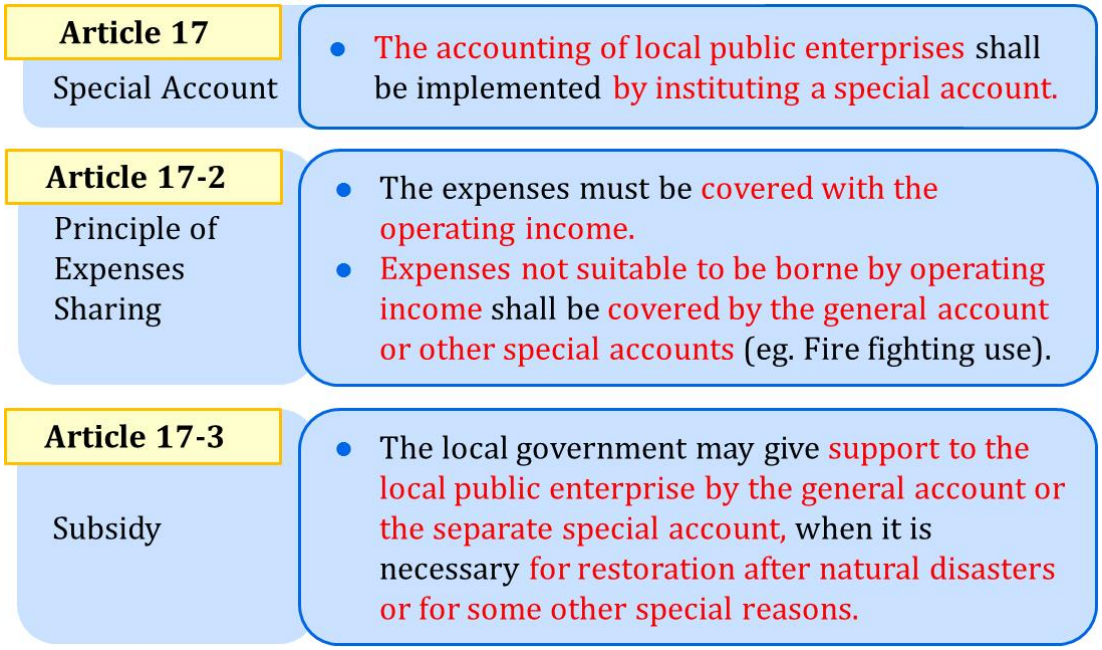


Figure 5. Local Public Enterprise Act (Article 17)

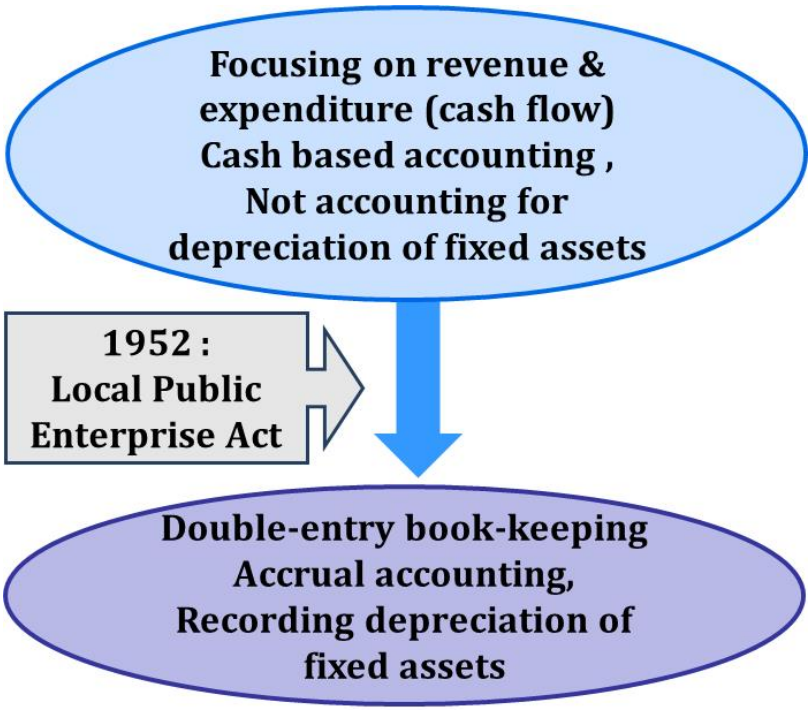


Figure 6. Change in Accounting System Related to Water Supply Business

(2) *Water Tariff Setting Manual*

The *Water Tariff Setting Manual* was prepared by Japan Water Works Association (JWWA), with the input from water utilities. It lays out the principles to be considered for water tariff setting. Water utilities calculate appropriate level of tariffs based on the standardized methodology.

Up till the late 1960s, each water utility established its own tariff system to cover the costs for water supply services. The government did not allow price hikes to counter soaring inflation in the postwar years (after 1945). Maintenance and construction costs were increasing because of the expansion of water supply facilities. Many utilities faced financial problems. In 1967, JWWA consulted with the utilities and prepared the *Water Tariff Setting Manual* so that utilities could make the best effort to generate sufficient revenue to ensure proper operation and maintenance, development and perpetuation of the water supply systems, and maintain the utilities' financial integrity.

The *Water Tariff Setting Manual* specifies that tariffs should be calculated so that the total revenue estimated for the period of three to five years would match the total costs. The total

costs are the aggregate of operating expenses (personnel costs, chemical costs, energy costs, repair costs, wholesale water costs, depreciation costs, capital consumption costs and other maintenance expenses) and capital costs (interest costs and capital maintenance costs). The tariff structure is designed by allocating these costs to each customer group based on the estimated total revenue from the tariffs. The total costs are broken down into customer costs (costs incurred from meter reading, door to door collection, and meters, which would be incurred regardless of the amount of water used), fixed costs and variable costs. The customer costs and a part of the fixed costs are allocated to the minimum rate, while the rest of the fixed costs and variable costs are allocated to the volumetric rate (See Figure 7). In the process of these allocations, special measures can be taken to reduce the burdens for some domestic water users as described in "4. Consideration for Low-Income Group."

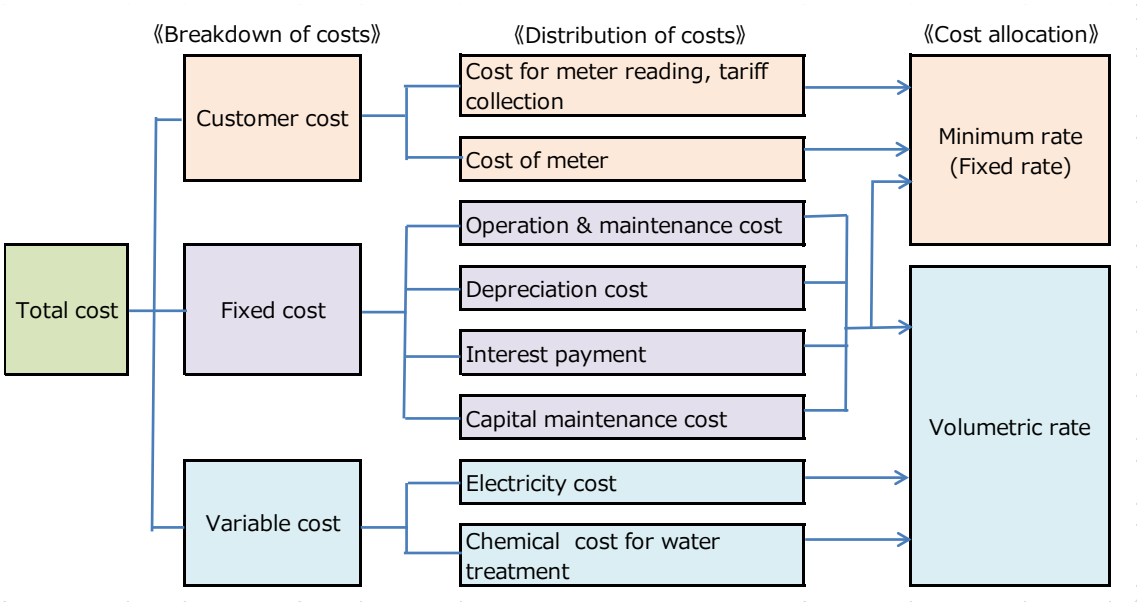


Figure 7. Calculation Steps and Cost Components for Water Tariffs

(3) Fairness and Clear Definition

When modern water supply was established in Japan, water tariffs were set based on the ability to pay. Metering was applied to very limited areas and a flat-rate system was generally adopted. With the expansion of metering, water tariffs were collected according to the amount of water used, and wasteful use was reduced. Water tariff structures continued to be improved using clear definitions to make them easier to understand.

Since the range of benefits (beneficiaries) and the degree (the amount of water used) are identified, the principle of beneficiary payment has been introduced into the water tariff system in Japan. It means that customers pay tariffs according to the amount of water used based on the principle of fairness.

The first water supply system in Yokohama (in 1897) was designed by a British engineer (Henry Spencer Palmer). Under the British influence, water tariffs were based on customers' ability to pay. Customers assumed to have the same ability were required to pay the tariffs according to the amount of water used. In some part of foreign settlements, customers paid minimum and volumetric rates. However, most of the water tariffs were based on the flat-rate system, and differential tariffs were set according to the number of family members and domestic animals such as horses and cattle (See Table 3).

Public taps were provided for low-income households, and monthly flat-rate charges were based on the number of households. The charges for public taps were significantly lower than private taps. Therefore, customers preferred to use public taps, and the utilities were not collecting the expected revenues. Monthly flat-rate charges were roughly decided based on the number of household' members and were estimated less than actual use. Therefore, even if a large amount of water was used, the revenue did not cover the expenses for delivering the service. By reference to the water tariff system in Yokohama, many refinements were made by other water utilities.

Table 3. Water Tariff Schedule of the First Modern Water Supply in Yokohama (1887)

Category		Rate	Current value (estimate)
General use for Japanese	Flat rate - base	Less than 10 people: 1 JPY/month	2,593 JPY/month
	Flat rate-increment	0.6 JPY for each additional 10 persons	1,556 JPY
	Volumetric rate	Less than 6,000 gallon: 1 JPY/month	Less than 27.3m^3: 2,593 JPY/month
	Volumetric rate	Less than 50,000 gallon: 0.16 JPY per 1,000 gallon	Less than 227.5$m^{3:}$ 415 JPY/ 4.55m^3
	Volumetric rate	More than 50,000 gallon: 0.1 JPY per 1,000 gallon	More than 227.5m^3 : 259JPY/4.55m^3
	Vessel	0.4 JPY per 1,000 gallon	1,037 JPY/4.55m^3
	Horse	1.5 JPY/year	3,890 JPY /year
	Cattles	1 JPY /year	2,593 JPY /year
	Dog-cart	1.5 JPY /year	3,890 JPY /year
	Four-wheeled carriage	2.25 JPY /year	6,483 JPY /year
	Lavatory use	0.3 JPY per 1,000 gallon	778 JPY / 4.55m^3
	Special use	0.35 JPY per 1,000 gallon	908 JPY/4.55m^3
	Public tap	0.9 JPY/month per tap for up to 6 households	2,334 JPY/month
	Public tap	1.5 JPY/month per tap for up to 12 households	3,890 JPY /month
	Public tap	0.5 JPY/month increases in each 6 households (in case of more than 13 households)	1,297 JPY/month
	Special Public tap	0.15 JPY/month	389 JPY/month
Foreign settlement	Flat rate	Annual house rental fee 300 JPY or less : 18 JPY/year	Annual house rental fee 778,000 JPY or less: 46,675 JPY/year
	Flat rate	Annual house rental fee 301-600 JPY : 6% of the rental fee	Annual house rental fee 778,001 JPY-1,555,000 JPY: 6% of the rental fee
	Flat rate	Annual house rental fee 601 JPY or more: 5% of the rental fee	Annual house rental fee1,555,000 JPY or more : 5% of the rental fee
	Volumetric rate	Less than 20,000 gallon: 1.6 JPY/month	Less than 91m^3: 4,149 JPY/month
	Volumetric rate	20,000 - 150,000 gallon: 0.24 JPY/1,000 gallon	91 to 683m^3 : 622 JPY /4.55m^3
	Volumetric rate	More than 150,000 gallon: 0.15 JPY/1,000 gallon	More than 683m^3: 389 JPY / 4.55m^3
	Vessel	0.4 JPY per 1,000 gallon	1,037 JPY / 4.55m^3
	Fountain	0.35 JPY per 1,000 gallon	908 JPY / 4.55m^3
	Sprinkling	0.35 JPY per 1,000 gallon	908 JPY/ 4.55m^3
	Flush lavatory use	0.3 JPY per 1,000 gallon	778 JPY /4.55m^3
	Horse	1.5 JPY/year	3,890 JPY / year
	Dog-cart	1.5 JPY/year	3,890 JPY / year
	Four-wheeled carriage	2.25JPY/year	5,834 JPY / year

*1UK gallon≒4.55 liter

Source: Based on the editorial committee of the One Hundred Year History of Policy and Administration for Water Supply, "*One Hundred Year History of Policy and Administration for Water Supply*," Ministry of Health and Welfare, 1990.

During the 1920s and 1930s, water rates charged to different classes of customers such as domestic, industrial/commercial, official or public bath house use, were gradually established. At the same time, in order to prevent wasteful use associated with the flat-rate system and to obtain appropriate revenue, more utilities adopted the volumetric system for households as well. After World War I, many cities began to introduce the decreasing-block rates to stimulate demand for large users and industries such as electric power stations and marine vessel construction companies in order to promote the development of industries. This is a schedule of rates applicable to blocks of increasing usage in which the usage in each succeeding block is charged at a lower unit rate than in the previous blocks.

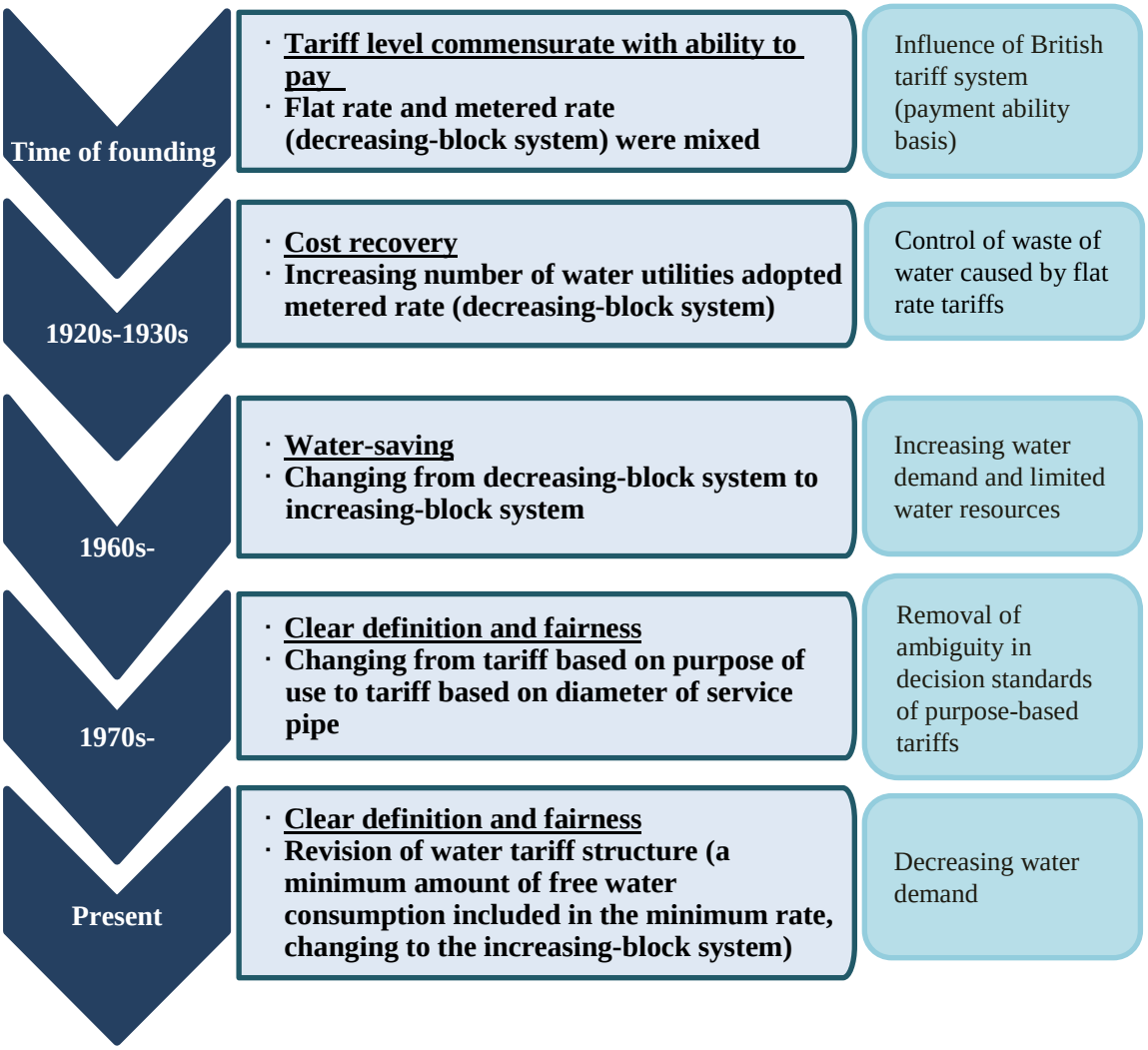


Figure 8. Changes in Water Tariff Structure in Japan

After World War II and during the period of high economic growth, the water demand sharply increased because of industrial development, population growth, and changes in lifestyle (installation of bath tubs in each house, conversion to flush toilets, etc.). Although water resource development and construction of new facilities were promoted, water supply services were unable to keep up with the demand. In order to control the amount of water use, utilities introduced an increasing-block rate around 1960. This is a schedule of rates applicable to blocks of increasing usage in which the usage in each succeeding block is charged at a higher unit rate than in the previous blocks.

Until the 1960s, the purpose-based tariff system had been widely adopted based on the concept of ability to pay. However, facing criticism for subjective and perceived arbitrary classification of customers such as domestic, industrial, and commercial, utilities were shifting to classification according to pipe size.

Column: Lawsuit in Osaka which Challenged the Fairness of the Purpose-Based Tariff System Contributed to the Shift to the Pipe Size Based Classification

Customer categories in Osaka City were classified under three types of use: “general”, “special”, and “public bath.” “General use” applied to buildings, department stores, factories and ordinary households. Inexpensive restaurants and inns were classified under “special use”. In 1967 a restaurant in Osaka filed a lawsuit challenging the fairness of this classification, claiming that the “special use” classification imposed unreasonably expensive, discriminatory, and unjustifiable tariffs, compared to those of general use. Osaka City won the case. The court ruled that the classification was reasonable based on public welfare. Nevertheless, many utilities switched to pipe-size-based classification which is more objective and eliminates the confusion associated with eligibility for each category. At the same time, the Water Tariff Setting Manual deemed that water tariffs based on pipe sizes are appropriate, although there is no direct association with the Osaka case.

It is important to design a tariff structure based on clear classifications, which is easy to understand for everyone.

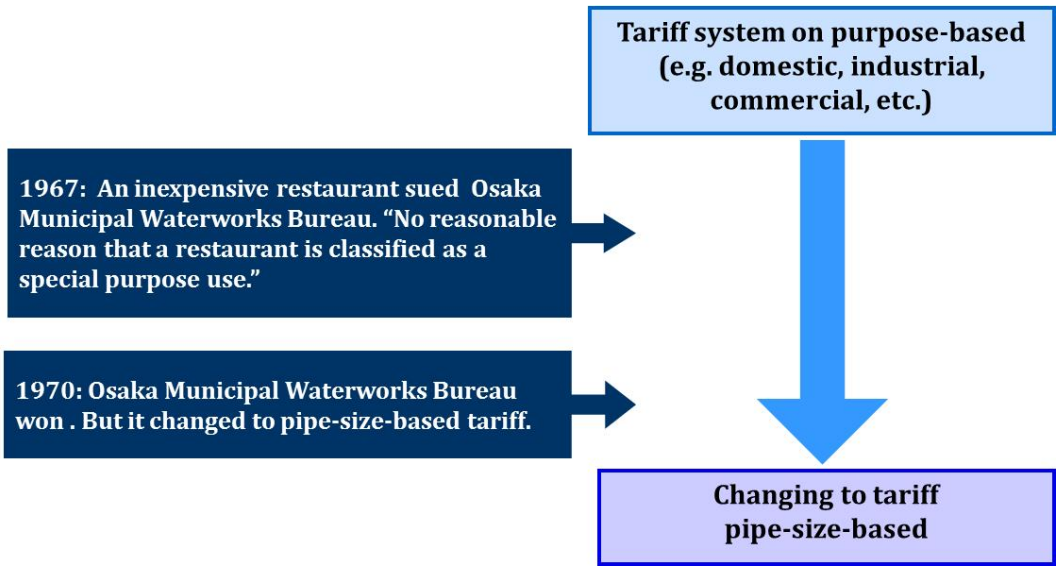


Figure 9. Setting of Water Tariffs Shifted from Purpose-Based to Pipe-Size-Based

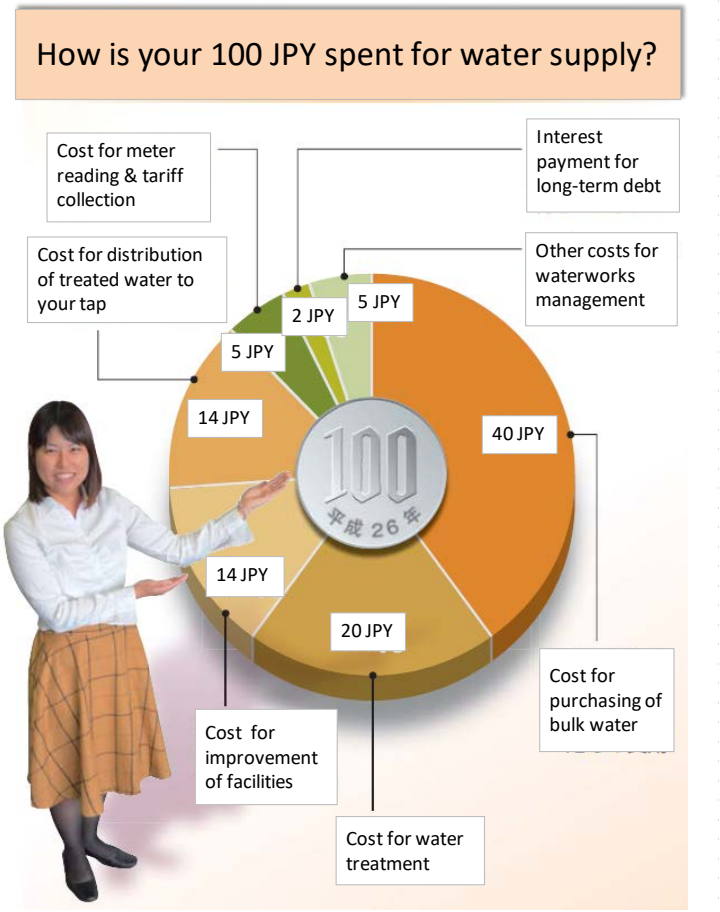
Two-part tariffs consisting of the minimum and volumetric rates are generally used in Japan. Some utilities still use purpose-based classification, but most have adopted pipe size-based system.

In recent years, water demand has declined with lower population growth and the advent of water-saving devices. More water utilities have examined the moderate amount of minimum volume (a certain amount of water included in the minimum rate for the purpose of encouraging water usage necessary for a daily life and public health) and the rate of each block in the increasing-block system.

(4) Transparency & Accountability, Public Relations

Japanese water utilities are fulfilling their accountability and promoting customer awareness by disclosing the details of the costs based on which the tariffs are set and other relevant management information.

In setting water tariffs, it is important to disclose the utility's financial information to gain the public's understanding of its business environment. Japanese utilities routinely disclose clear and detailed information on personnel costs, repair costs, electric power expenses, etc. to fulfill their accountability to the customers, and improve their understanding of the business (Figure 10). Delivering service of sustained high quality (safe and stable water supply, prompt responses to customers' enquiries) also fosters the customers' understanding of the need for tariff increases.



Source: Kawanishi Water and Sewer Bureau, *Water Supply and Sewerage in Kawanishi: Secure for Drinking, Comfortable for Using*, 2015, http://www.kawanishi-water.jp/ikkrwebBrowse/material/files/group/2/h27-12-1.pdf

Figure 10. Breakdown of Costs for Every 100 JPY of Water Tariff

Collection of charges for utilization of public facilities is stipulated under the Local Autonomy Act (Article 225) and the Local Finance Act (Article 24) in Japan. Utilities as public facilities that serve the local residents, are legally allowed to collect tariffs. By the same token, they are required to explain clearly to the residents about the management of the service. Residents on their part should be interested in and be supportive of the business.

(5) Efficient Management

Water tariff levels must be based on reasonable costs incurred under efficient management. Utilities are expected to make continuous efforts to rationalize and streamline their operations.

The Water Supply Act and the Public Enterprise Act require that utilities manage the water supply business efficiently so that costs can be covered by revenue generated from water tariffs set at affordable rates. Utilities are making continuous efforts to rationalize and to streamline their operations, specifically, with reduction of non-revenue water, more efficient administrative processes, re-allocation of personnel after facility upgrades and outsourcing of operation and maintenance. In recent years, construction costs are dropping because new technologies are shortening the construction period. Involvement of the private sector through PFI projects also contributes to further cost savings.

Example: Promotion of Efficiency in Osaka Municipal Waterworks Bureau

Osaka Municipal Waterworks Bureau faced very severe financial conditions when water demand decreased significantly from 1973 to 1980. A committee was established to find cost savings through more efficient management including personnel cost reduction in 1980. For 3 years (1980-1983) the workforce was down-sized through attrition. In 1984 shift assignments in treatment plants and distribution reservoirs were under review. Staff were re-assigned when water treatment plants acquired better equipment (1987 and 1993-1994) and again in 1990-1991 when online system and data processing of meter reading records were introduced. By 1988-1990, only half of the retired staff was replaced. The number of meter readings was reviewed in 1992, and work related to accounts and water tariffs was integrated in 1994.

Source：Osaka Municipal Waterworks Bureau, "*One Hundred Year History of Water Supply in Osaka City*," Osaka Municipal Waterworks Bureau, 1996.

Photo 4. Equipment Introduced for Online System in Osaka City

4. Consideration for the Low-Income Group

(1) Minimum Volume and Cross Subsidy in Water Tariff Structure

In Japan, the affordability of water for low-income households is considered when designing water tariffs. The minimum rate includes a minimum volume. Many water utilities use cross-subsidies.

Article 1 of the Water Supply Act stipulates the "supply of clean, abundant and affordable water" to all residents. Water tariffs have to be set at a level that is affordable to customers including low-income households. By including a minimum volume in the minimum rate and allowing for cross-subsidies, low-income households are assured adequate water supply for their daily needs at an affordable rate.

The minimum rate paid by customers regardless of the amount of water used, should cover fixed costs incurred by the water supply system. To achieve this, the minimum rate would be extremely high. The cross-subsidy system allows the low-income users to pay the minimum rate (which includes a minimum volume of water) while charging users of larger quantities higher rates to make up the difference. Many water utilities adopted 5 - 10 m^3 as the amount considered minimal for public health requirements.

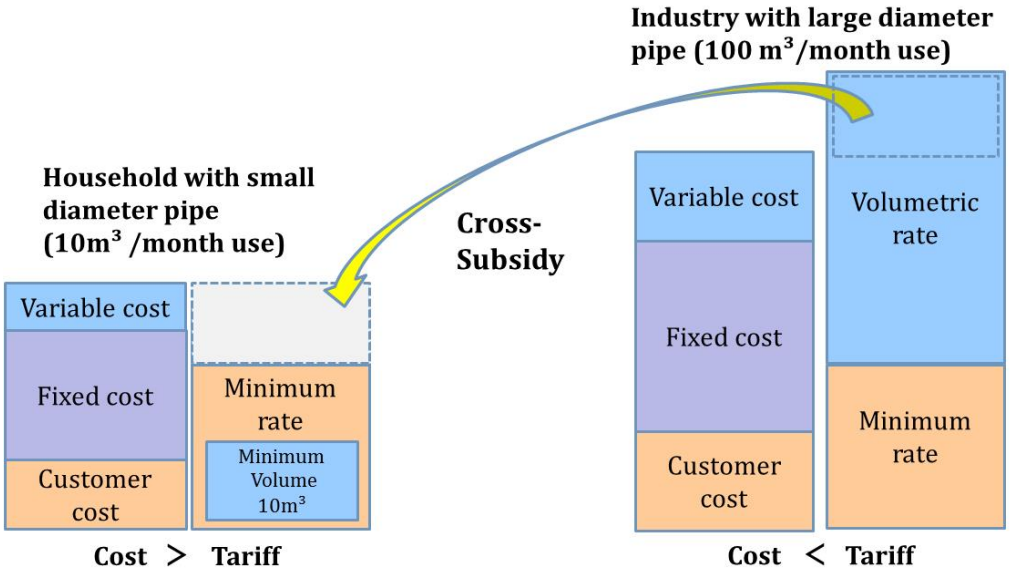
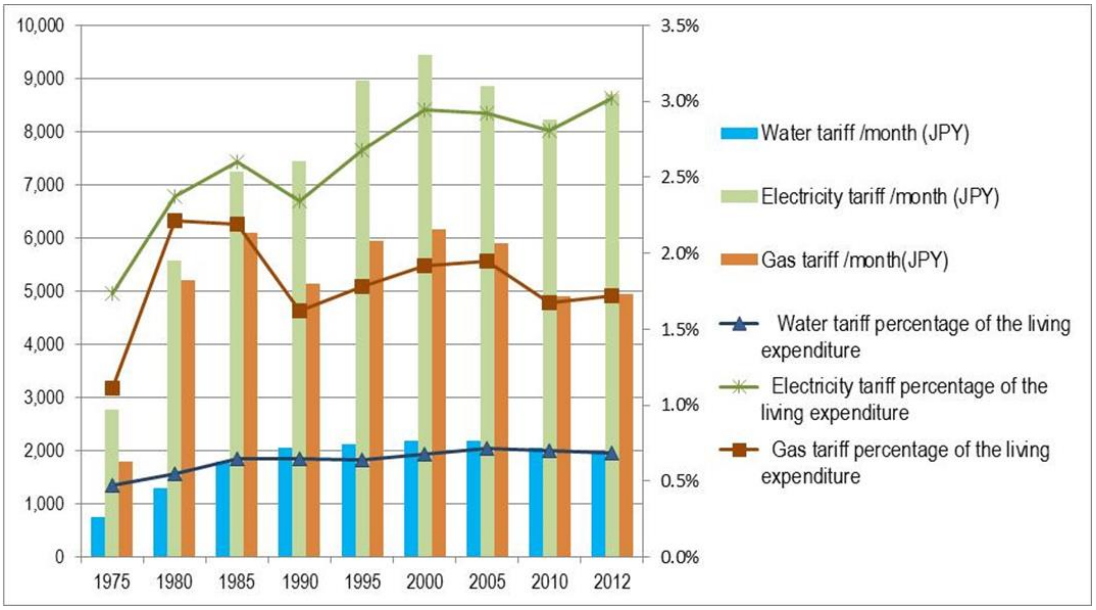


Figure 11. Diagram of Minimum Charge and Cross-Subsidy Concept

Column: Proportion of water tariffs as part of living expense

Figure 12 shows the proportion of water, electricity and gas tariffs as parts of monthly living expenses over the last 3 decades. Compared to tariffs for electricity and gas, water charges at 0.7% of monthly living expenses can be said to be affordable.



Source: Created from the data of JWWA, *"The outline of water supply,"* 6th ed. 2015.

Figure 12. Water, Electric, and Gas Tariffs to Average Monthly Living Expenditures

(2) Water Tariff Exemption

Some water utilities introduce reduction and/or exemption measures in water tariffs by clarifying the definition of low-income households.

Some water utilities introduce reduction and/or exemption measures to accommodate low-income households or persons on welfare, as stipulated in ordinances of the local government, as a part of the welfare policy. Local governments usually compensate the utilities for the lost revenue, using funds from their general accounts.

Example: Rules for Exemption from Minimum Charge in Water Tariffs in Tokyo

Recipient qualification:

- A household who receives public assistance, such as livelihood assistance, education allowance, home allowance, medical allowance or nursing-care allowance under the Public Assistance Act.
- A household who receives "childcare allowance" or "special child-rearing allowance" (persons with a child aged 18 or under in one-parent families below the income line, and parents with a child aged 20 or under with a physical or mental disability, below the income line).

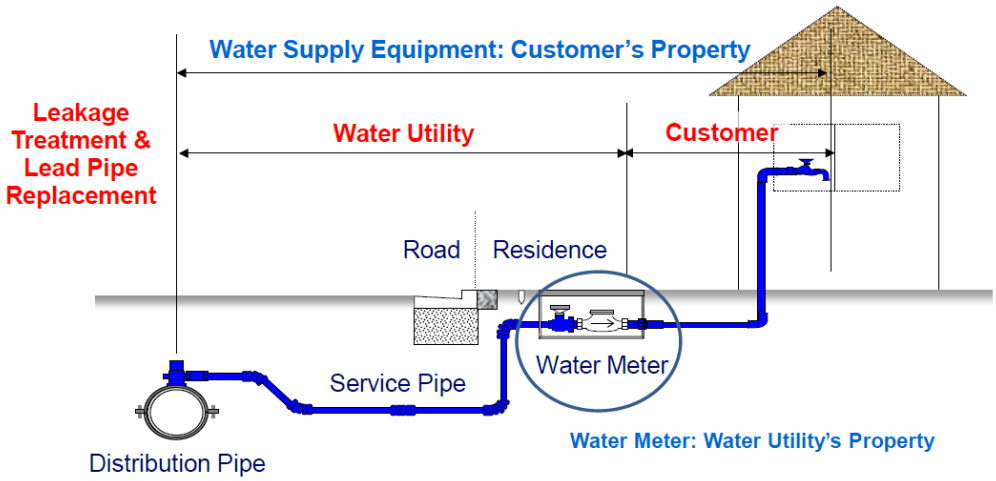
Reduced and exempted:

- Total of the minimum and volumetric charges up to 10 m^3 per month.

(3) Water Meter Policy & Connection Charge

In Japan, water meters are owned by the utilities and leased to customers. Customers are prohibited from breaking and removing water meters without permission. Costs associated with connecting to the water supply system are paid by customers. At the early stage of the modern water supply system, monthly installments and a fund for house connections were set up to help customers pay the connection charges.

Figure 13 illustrates the typical customer service connection. A customer owns and pays for the service connection equipment from the distribution pipe to the tap (excluding the water meter). The meter is on loan from the utility. The utility is responsible for maintenance of the service pipe and water meter. Customers are prohibited from tampering with or removing water meters.



Source: JWWA

Figure 13. Typical Water System Components

In Osaka, when the water supply system was firstly built, a fund was set up to help with the payments of house connections in order to promote the use of the service. Residents could pay the connection charges by monthly installments. Initially, it was 10 month installments, but this was later changed to 60 months. These initiatives were successful in encouraging house connections for the people unable to cover the connection charge in a single payment.

In rural areas where Small Scale Public Water Supply were developed, villagers relied on their own savings by putting away small amounts every day, to pay for house connections. For example, villagers set targets such as saving the price of one egg each day or saving money that they would have spent on drinks, and put that towards water supply that would relieve their hardship in fetching water.

5. Billing and Collection

In Japan, the water bill collection rate was improved by changing the interval between billings, how the charges were collected, and by enforcing collection of unpaid bills. Incentives offered to meter readers and tariff collectors also helped.

In the early days, water tariffs were collected the same way as taxes. Payments were usually made three to six times per year. The onus was on the customer to pay at the water utility. The collection rate was low. A customer might move away without informing the authorities, and there would be no way to track down outstanding payments. Urban residents inevitably had many expenses to deal with around paydays. Paying the water bill payment three to six times per year did not always make it to the top of the list. Water utilities began to shift to door to door collection to improve the collection rate.

The collection rate was further improved when payment by bank transfer was introduced. This became even more convenient when customers can pay the water charges at convenience stores which are open 24 hours a day, 7 days a week.

Each utility has guidelines and dedicated units for dealing with unpaid water bills. Customers would be reminded to pay the outstanding charges and advised of penalties such as suspension of water supply, according to clearly stated procedures. One water utility set up a special week to collect unpaid tariffs from delinquent accounts and implemented supply stoppage when final reminders are ignored. However, in cases of non-payment due to special circumstances such as illness or unemployment, etc., water supply connection is usually maintained at the discretion of the executive managing director of the utility. When one-time payment of water tariff is difficult, many utilities accept payment by installments.

In meter reading and bill collection, a performance based incentive system which tied wages to number of meters read and collected payments, improved collection rate. In the past, some meter readers skipped actual readings, and estimated volume used. Managers had to carry out spot checks, set standard procedures for meter reading, and provide training.

More than 90% of the utilities outsource meter reading, while providing internal and external training for staff in charge of billing and collection. Japan Water Works Association offers training programs on billing and collection.

Example: Changes in Water Bill Collection and Handling of Unpaid Tariffs in Osaka Municipal Waterworks Bureau

When Osaka Municipal Waterworks Bureau completed the installation of water meters in 1910, customers paid their water bills on a quarterly basis. From 1926 to 1931, only 30% of the customers actually did so. The Bureau implemented various measures, but only managed to collect 95 to 96 % by the end of the settlement period. With monthly door to door collection, the rate reached 99.9% in four years, and 100% after nine years.

Payment by account transfers was introduced in 1966. The overall efficiency actually declined when both methods (account transfer and door-to-door collection) were used at the same time. Door-to-door collection was abolished in 1975 when most households have no one at home during the day. Family groups consisting of two parents and their children increased, and both of parents went out to work. The unpaid amount went up. The payment method shifted to account transfers, and the transaction was expanded to more financial institutions.

In 1993, convenience stores started to handle water tariff payments, so that customers could pay during holidays and after hours. Tariff collectors were replaced by dedicated personnel assigned to manage receipt of payments and settle unpaid bills. A manual on settlement of unpaid bills was prepared.

Table 4. Changes in Billing and Collection in Osaka Municipal Waterworks Bureau

Period	Collection system	Remarks
1910 - 1930	Quarterly payment by customers	(Issue) Only 30% customers paid water bills by due date. Bureau used various procedures to secure payments, and was able to collect 95% of tariffs. The office could lose track of customers if change of address was not reported.
1931	Introduction of monthly door to door collection	(Result) 99.9% collection rate was achieved in four years after the introduction, and 100% in nine years.
1966	Introduction of bank account transfers	(Result) More customers shifted to account transfers every year, helping improve the efficiency and reduced the need for cash handling.
		(Issue) The overall collection rate declined when account transfer and door to door collection were both in use at the same time. More households had no one home during daytime, because family groups consisting of two parents and their children increased and both of parents went out to work. The unpaid amount went up.
1975	Door to door collection system was abolished	Tariff collectors were replaced by dedicated personnel assigned to receive and manage payments and settle unpaid bills. A manual on settlement of bills was prepared to set standard procedures for resolving overdue accounts.
	Gradual promotion of account transfers, and expansion of financial institutions handling them	
1993	Start of handling payment in convenience stores, payments can be made during holidays and at night	

Source: Base on Osaka Municipal Waterworks Bureau, "*One Hundred Year History of Water Supply in Osaka City*," Osaka Municipal Waterworks Bureau, 1996.

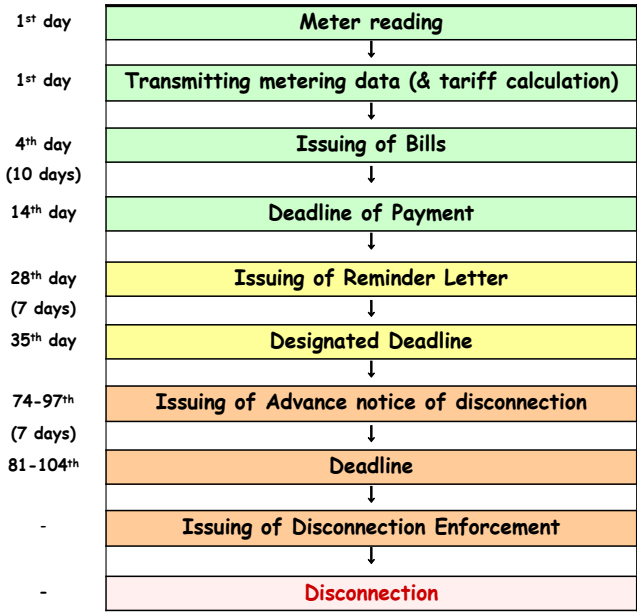
Example: Challenges and Solutions Concerning Meter Reading and Door to Door Collection System in the Bureau of Waterworks, Tokyo Metropolitan Government

When the door to door collection system was adopted in Tokyo, meter reading and receipt of payment were carried out by separate sets of workers to avoid unlawful handling of the transactions. The problems facing collectors included customers often not able to pay at the time, or collectors not willing to accommodate customers' request to come after office hours. The collection rate was not good. In order to improve the collection rate, the Bureau hired workers with more interpersonal experience and introduced incentives that tied compensation to performance (number of visits and payments collected). The Bureau also introduced on the job training for collectors and replaced analogue meters with digital ones for more accurate readings.

Even though the Bureau provided meter readers with generous benefits such as allowance per customer, daily travel expenses and transfer to office work after four years, it was difficult to hire and retain enough meter readers. Eventually meter reading was outsourced.

The collection procedure for unpaid water bills in the Bureau of Waterworks, Tokyo Metropolitan Government is shown in Figure 14. The customer is sent a reminder, followed by an advisory letter, and the notice of disconnection, and eventually the water supply is disconnected. The process is well-publicized, which also contributed to the decrease in unpaid tariffs.

The bill collection rate of the Bureau of Waterworks of Tokyo Metropolitan Government is 99.9%.



Source: Training Materials prepared by Nihon Suido Consultants Co., Ltd.

Figure 14. Bill Collection Procedures for Nonpayment – the Bureau of Waterworks, Tokyo Metropolitan Government

Meters are housed in boxes and replaced every eight years as stipulated under the Measurement Act. They should be in good working order to ensure that the readings are accurate.

6. Lessons Learned

The following Japanese experience could be useful for other countries.

- **(Financial Sources for Water Supply Development)** Water supply facilities were developed using public enterprise bonds and subsidies. Utilities borrowed large sums at low interest rates and long repayment periods from public financial sources. Subsidies based on well-defined policy goals were granted. This government financial assistance contributed greatly to achieving universal access to water supply service. Public enterprise bonds are an effective and fair way to share the liability of the construction costs among existing and future customers. It is important to have a financial plan showing that water tariffs can generate enough revenue to cover debt repayment and demonstrate financial soundness.

- **(Subsidies for Nationwide Water Supply Coverage)** Although it is desirable to cover all expenses with the revenue from water tariffs, subsidies were required to achieve nationwide water supply coverage and develop water resources in Japan. Especially, in rural areas with small populations, it has been difficult to cover the construction costs of the facilities with tariffs alone. Rural water supply was developed by subsidies and contribution from villagers.

- **(Tariff Setting)** In Japan, water tariffs are set based on the following policies and principles: (1) utilities use the fully distributed cost method and self-supporting accounting system, (2) financial liability for construction of facilities is shared equitably and there is absolute clarity in how tariffs are set, (3) efficient management of the utilities, (4) affordability, and (5) adequate information disclosure. It is important to have the appropriate legal framework and standardized procedures to guide the tariff setting process. Utilities make continuous efforts towards efficient management and information disclosure so that customers clearly understand and support the water supply business.

- **(Affordability)** To support all households including low-income groups, water tariffs are made affordable by including a minimum volume in the minimum charge and implementing cross-subsidies. Exemption and reduced tariff systems are established as a welfare policy of the local government. The qualification targets for low-income groups are clearly defined by ordinances. Customers could pay by installments for costly new connections and were encouraged to save money systematically for the payments.

- **(Increasing Bill Collection Rate)** Japanese water utilities have achieved a bill collection rate of nearly 100% by shifting to a payment system that is convenient for customers. It is important to find the easiest way for customers to pay depending on the financial services available. There are clear procedures for following up on unpaid bills and applying penalties as required. Training for meter readers and tariff collectors together with performance based incentives could also help raise collection rates. Installation of meters at all customers and keeping meter accuracy, have also contributed to high collection rates.