

# Japan's Experiences on Water Supply Development: Overview



No. I1 Ver. 1

**Nishiya Water Treatment Plant in  
Yokohama**

# Contents

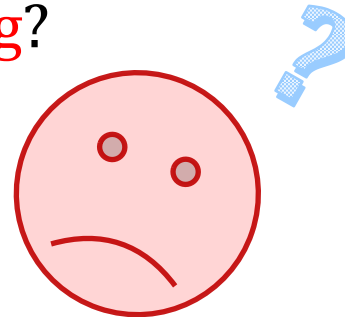
- 1. Introduction**
- 2. Goal 6 of SDGs and Japan's Experiences**
- 3. Universal and Equitable Access**
- 4. Safe Drinking Water**
- 5. Sustainable Water Resources Management**
- 6. Ensuring Availability**
- 7. Efficient Water-Use**
- 8. Sustainable Management**
- 9. Affordable Drinking Water**
- 10. Engaging Local Communities**
- 11. Lessons Learned**

# 1. Introduction

## Frequently asked questions from participants of the water supply training courses

**Q1.** How has Japan achieved almost **100% water supply coverage**?

**Q2.** How can Japanese waterworks provide around the clock supply of **safe affordable drinking**?



## 2. Goal 6 of SDGs and Japan's Experiences



**Goal 6: Ensure availability and sustainable management of water and sanitation for all.**

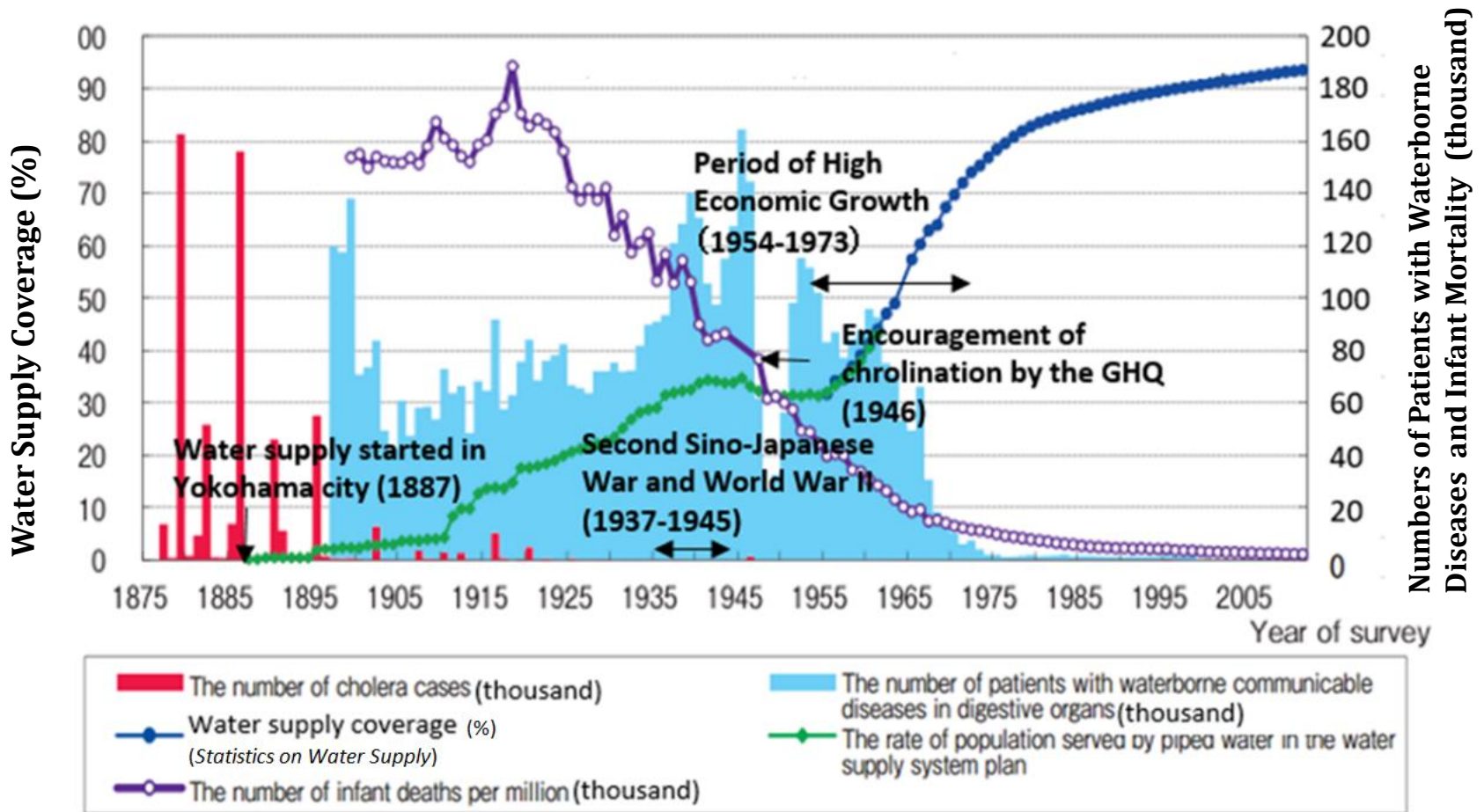
### Water Supply Targets

- Universal and equitable access
- Affordable
- Safe
- Efficient water-use
- Integrated resource management
- Public engagement

### Japanese Achievements

- **Almost 100% water supply coverage**
- Water tariff system structured with consideration for **low income groups** as well as **ensures full cost recovery**
- **High-quality tap water to all customers**
- **Low leakage rate (4.69% in 2013)**
- **Securing water resources in collaboration and coordination with all stakeholders**
- **Always moving forward with full support of local communities**

### 3. Universal and Equitable Access



Source: Added to the figure from Water Resources Department, Water and Disaster Management Bureau, Ministry of Land, Infrastructure, Transport and Tourism, "Water in Japan," <http://www.mlit.go.jp/common/001044443.pdf>

## 3. Universal and Equitable Access

### (1) Reducing Incidence of Waterborne Diseases

- Water supply system was developed **as a measure to improve public health** and to prevent the spread of **waterborne diseases**.
- Water supply distributes filtered and disinfected water through pressured iron pipes.
- Cholera outbreaks were eliminated in Yokohama in 1887 .
- **The Waterworks Ordinance** was enacted in 1890 .



Establishment of Yokohama water in 1887



Sekiguchi weir of Kanda Josui (Waterworks) in 1919

Tokyo Waterworks Historical Museum

<http://www.suidorekishi.jp/minitenji2015.html>

# 3. Universal and Equitable Access

## (2) Development of Nationwide Water Supply System

The following measures were implemented:

- **Funding for urban water supply:**  
from municipal bonds purchased by public funds  
(public financial institutions, pension funds, etc.)
- **Funding for rural water supply:**  
subsidies for small-scale utilities (1952)
- **Enactment of the *Water Supply Act*** (1957)
- ***Approval (License)*** system requiring master plans
- **Human resources development**
- **Enactment of “*Guidelines for Water Supply Facilities Standards*”** (1966)



## 4. Safe Drinking Water

### (1) Water Quality Standards and Facilities Standards under the Water Supply Act

Standards are revised periodically as new knowledge emerges on toxic substances and the public concerns, and the technical level of water quality testing.

#### Water Supply Act

- Article 4 Drinking Water **Quality** Standards
- Article 5 Water Supply **Facility** Standards
- Quality assurance in Construction  
→ Article 12,13,16, etc.
- Appropriate Operation  
→ Article 19-23, etc.

Facility to secure safe water

Check and Support

The Ministry of Health,  
Labour and Welfare

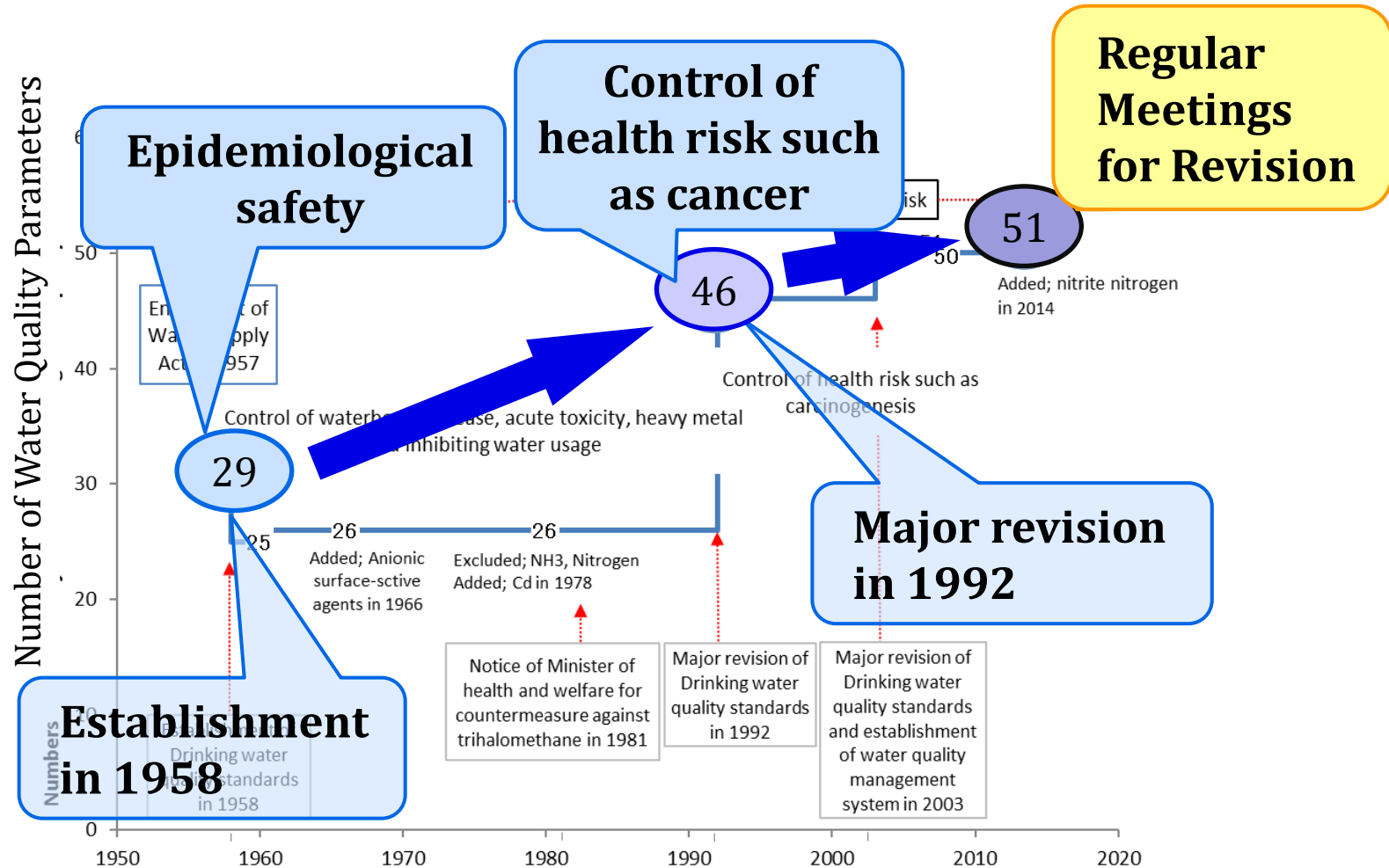
Health center

Water utilities



# 4. Safe Drinking Water

Water quality standards have been reviewed periodically.



# 4. Safe Drinking Water

## (2) Chlorination

Chlorination after WWII contributed considerably to safe water supply.



**Chlorination system**

Source: Kyoto City  
<http://www.city.kyoto.lg.jp/suido/page/000092339.html>

### Advantages

- Prevented waterborne diseases
- Reliable process
- Easy and simple
- Low cost

### Disadvantages

- Toxicity
- Generation of disinfection by-products
- Corrosion of equipment

## 4. Safe Drinking Water

### (3) Quality Management of Materials and Equipment

Standards and certification system that **ensure materials and equipment quality:**

- Japanese Industrial Standards (JIS)
- JWWA (Japan Water Works Association) standards
- Examinations and certification by JWWA

#### Sticker attached to standards conforming products

##### Sticker attached to basic standards conforming products

This mark is allowed to be affixed to those products that are certified as conforming to the seven (7) items of performance-based standards specified by the Ministerial Ordinance of the Ministry of Health and Welfare.



In the case of seal (in recommended color)



In the case of stamping

##### Sticker attached to special standards-conforming products

This mark is allowed to be affixed to those products that are certified as satisfying the ease-of-use, comfort, and other performance features in addition to the seven (7) items of performance-based standards (basic standards) specified by the Ministerial Ordinance of the Ministry of Health and Welfare.



In the case of seal (in recommended color)



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# 5. Sustainable Water Resources Management

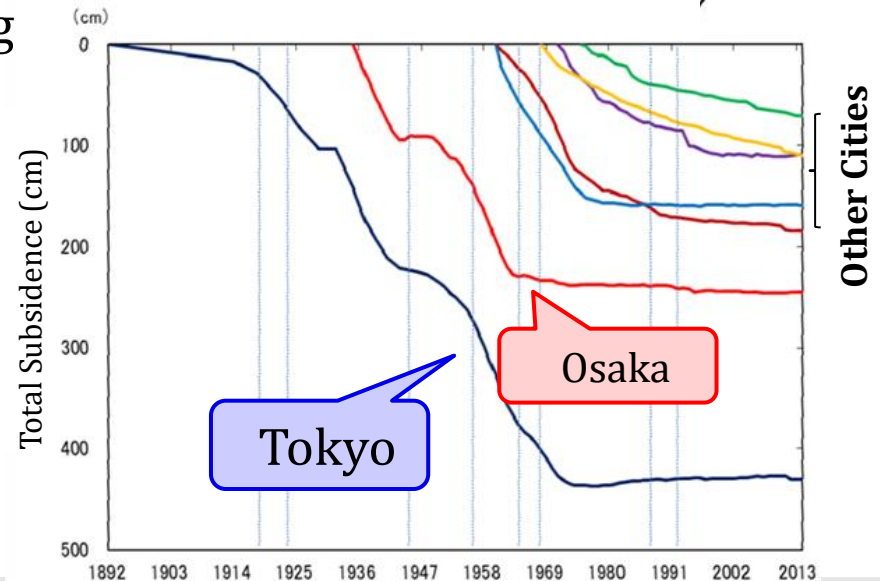
## (1) Securing Water Resources

To meet increasing demand - must conserve water quality and work with **other users**.

- Development of **multipurpose dams** for efficient investment, and for bulk water supply system
- **Control pollution of water resources**
- **Control depletion of groundwater sources and prevention of land subsidence** caused by over pumping

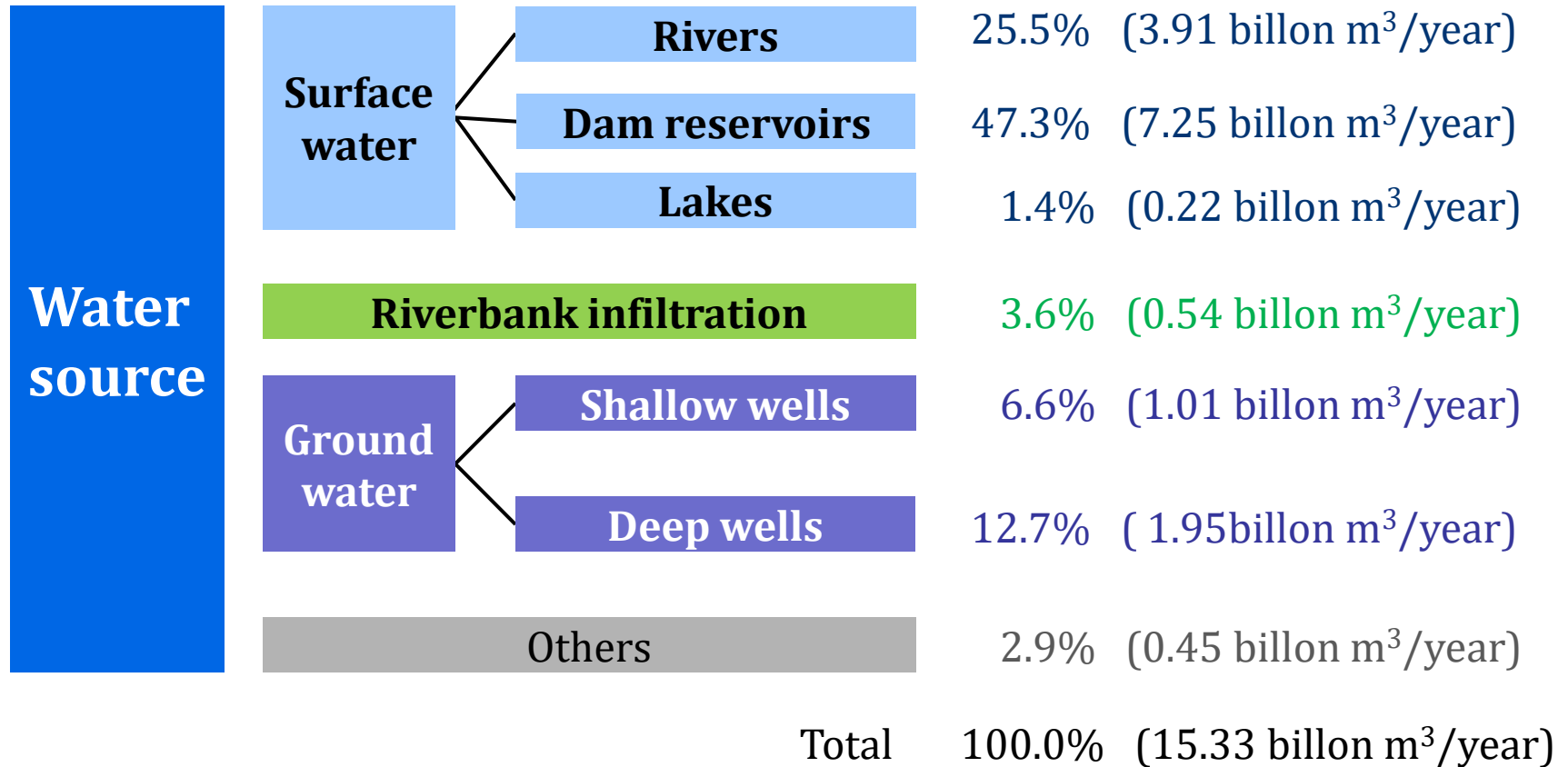


**Multi purpose dam**



**Land subsidence controlled since 1970s.**

# 5. Sustainable Water Resources Management

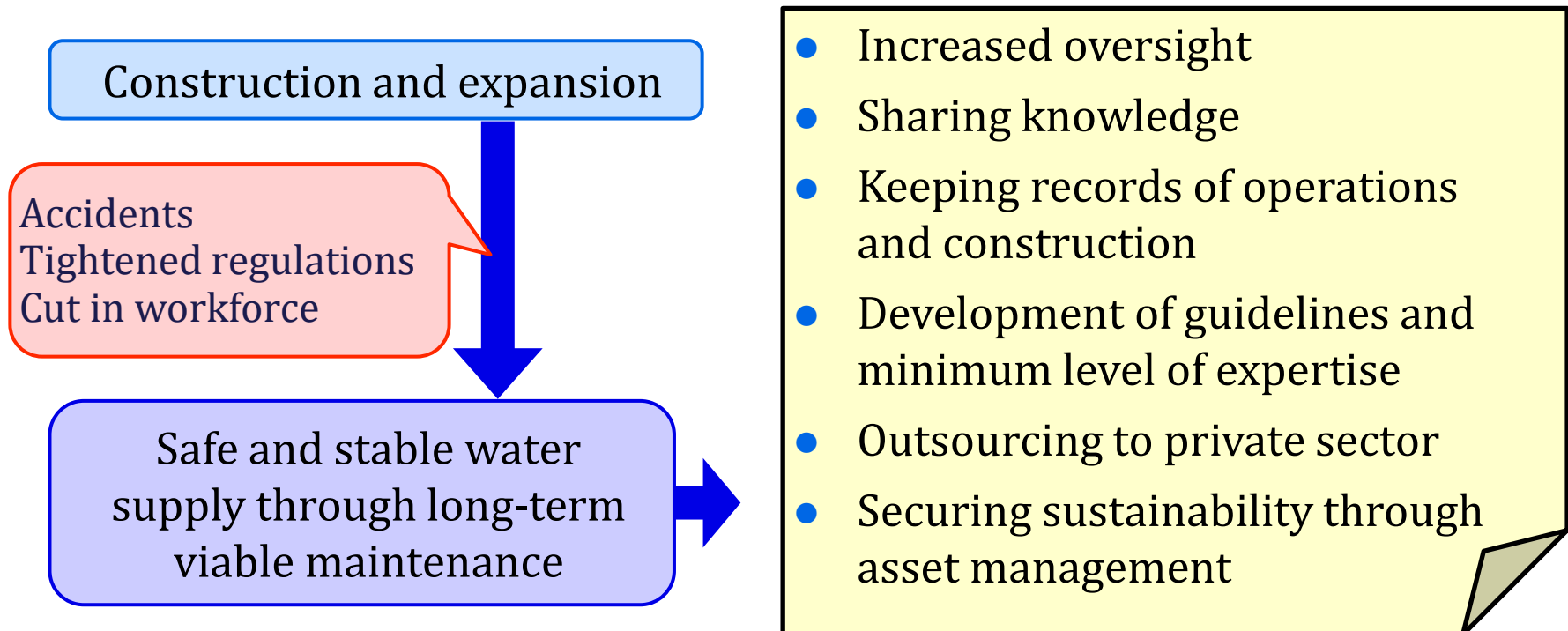


Source: JWVA, *Water Sources in Japan (2014)*,  
<http://www.jwwa.or.jp/shiryuu/water/water02.html>

## 6. Ensuring Availability

### (1) Operation and Maintenance of Facilities

The national government and water utilities **worked closely** to enhance management of facilities through investigation and by sharing lessons. **Preventive maintenance** through Time Based Maintenance (TBM) and Condition Based Maintenance (CBM) is essential, and is implemented by keeping record and sharing information.



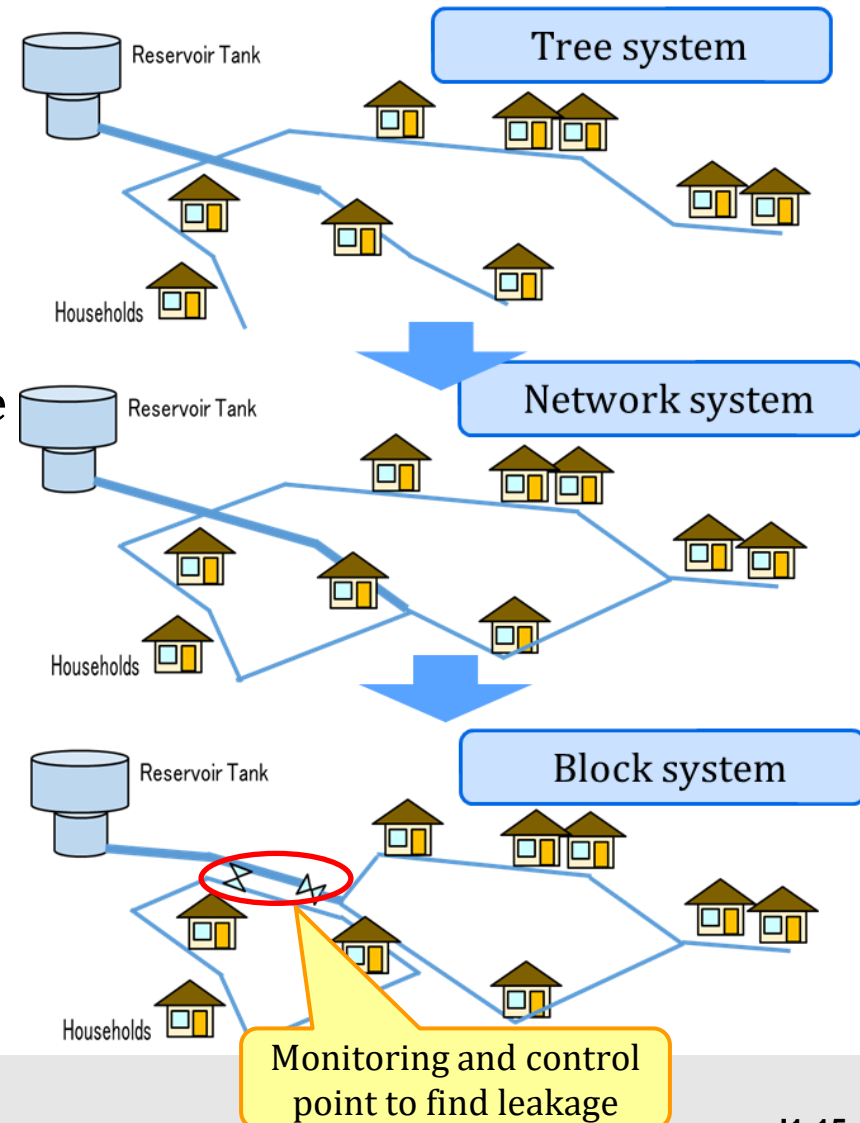
# 6. Ensuring Availability

## (2) Water Supply Operation by Efficient Water Distribution Systems

### Systems

Equalizing water pressure and shortening downtime by using **block distribution system**.

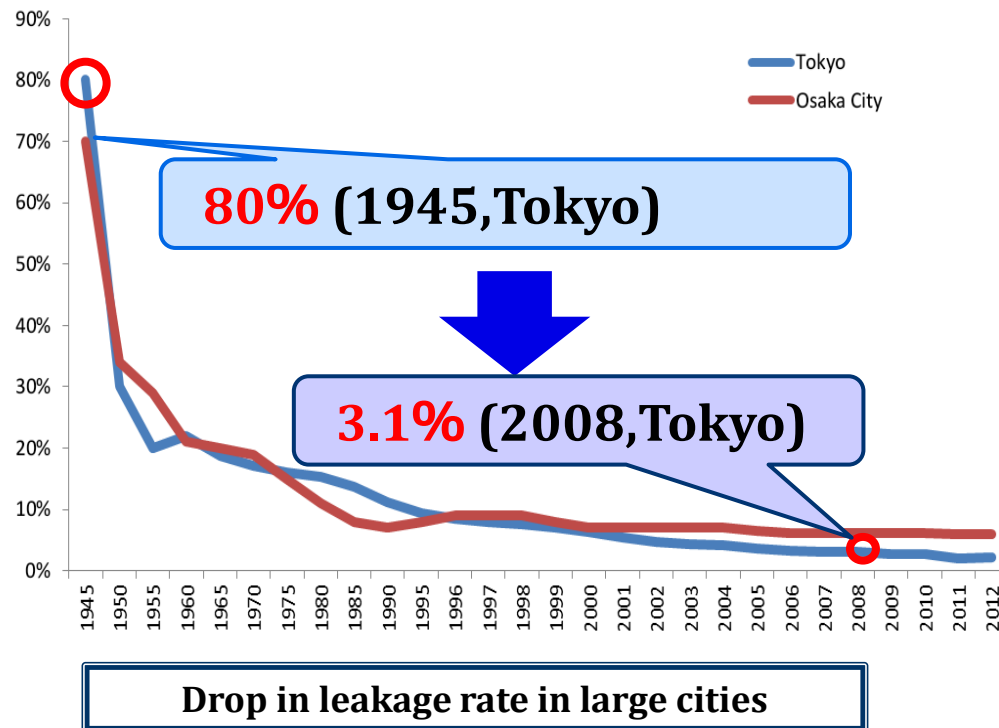
- 1<sup>st</sup> stage: **Tree (dendritic) system** for simple distribution
- 2<sup>nd</sup> stage: **Network system** to minimize the negative impact of accidents and ensure operational flexibility
- 3<sup>rd</sup> stage: **Block system** for
  - (1) optimizing water pressure,
  - (2) understanding distribution condition and optimizing operation
  - (3) identifying and minimize accidental damage and providing of backup water supply



# 7. Efficient Water-Use

## (1) Water Leakage Prevention

Average leakage rate dropped to 4.7% (2013) from 70-80% in 1945. Efforts prompted by serious droughts and accidents involving the suspension of service.

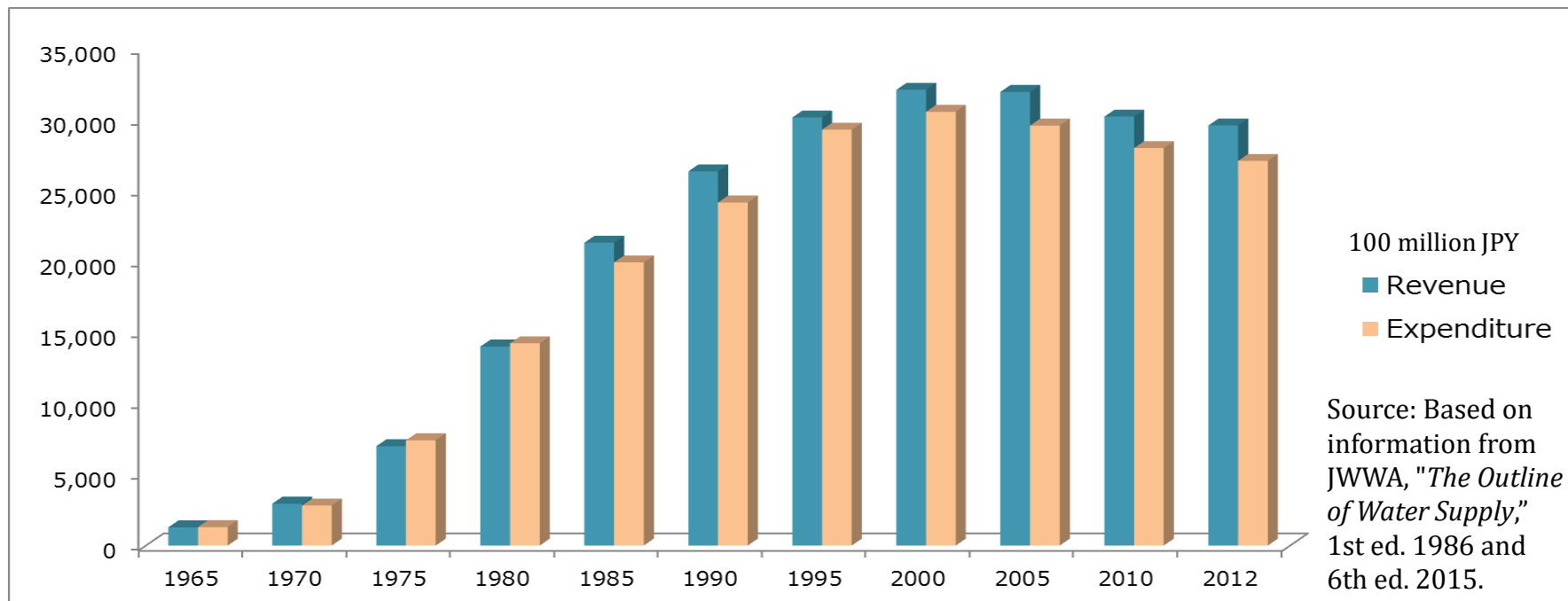
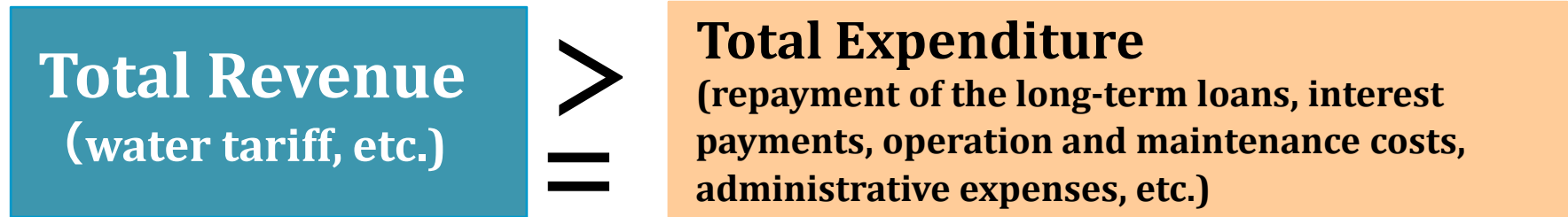


- Improved quality of pipe materials and active leakage control.
- Ensuring meter accuracy and scheduled replacement as required by the Measurement Act.
- Reduction of measurement errors, rare unauthorized/illegal connections.



# 8. Sustainable Management

## (1) Self-Supporting Accounting System and Cost Recovery



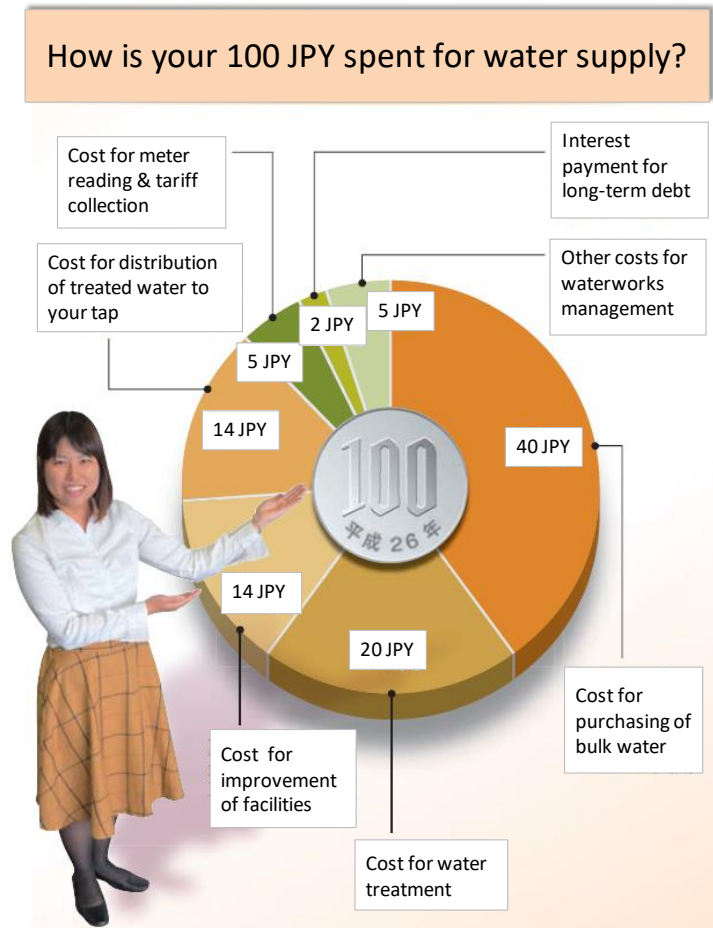
Change in Total Revenue and Expenditure of Water Utilities in Japan

## 8. Sustainable Management

### (1) Self-Supporting Accounting System and Cost Recovery

Setting tariff systems based on:

- Fairness (beneficiaries pay principle)
- Affordability
- Clarity in the pricing of water tariff
- Transparency & accountability
- Understanding of customers
- Efficient management



Source: Kawanishi Water and Sewerage Authority  
<http://www.kawanishi-water.jp/ikkrwebBrowse/material/files/group/2/h27-12-1.pdf>

## 8. Sustainable Management

### (2) Customer Relations

Starts with understanding the fundamental importance of water tariffs.

The Water Supply Act stipulates that :

- A water utility shall specify " Water Supply Rule" including water tariff calculation, cost of service connection, and condition of water supply.
- A water utility has the obligation to supply safe drinking water.
- A water utility shall notify customers of the results of water quality testing, and other information about water supply services.

Staff repairing a tap



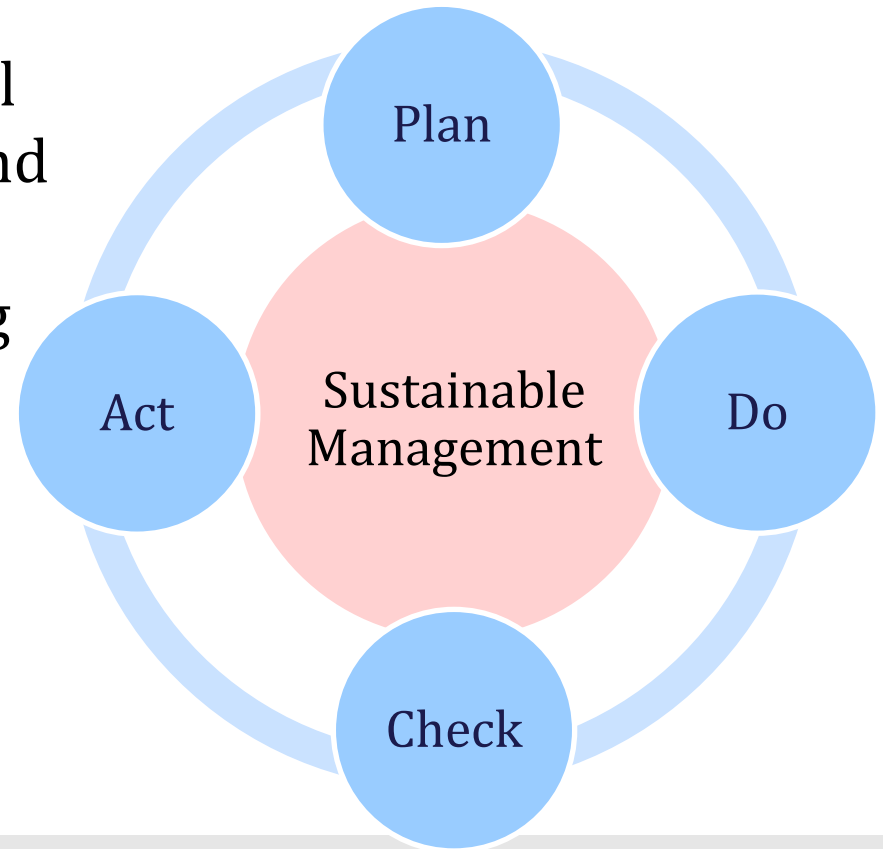
Source: Osaka Municipal Waterworks Bureau, "One Hundred Year History of Water Supply in Osaka City," Osaka Municipal Waterworks Bureau, 1996.

## 8. Sustainable Management

### (3) Master Plan, Business Plan and PDCA Cycle

**Master plans and business plans are essential.** They are guideposts for sound day to day management, while visualizing the path toward future directions.

- In the preparation of plans, all staff members are engaged and share objectives. It is a good opportunity for team building
- PDCA ensures the continuous improvement of sustainable business operations.

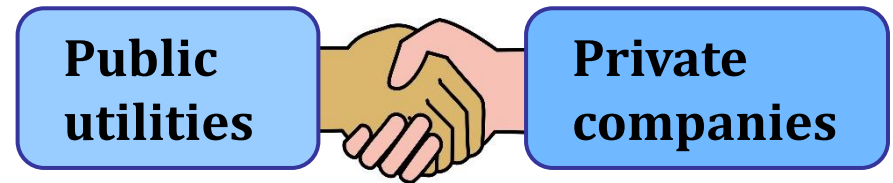


## 8. Sustainable Management

### (4) Public-Private Partnerships (PPP)

Involvement of private companies in the water supply business is increasing.

- Private companies must be qualified and are inspected to ensure that their performance meet national standards.
- PPPs are promoted under **legal frameworks with clearly defined allocation of the risks** among the parties.



Inside of water purification plant “CERAROKKA”; built by PFI scheme in Yokohama

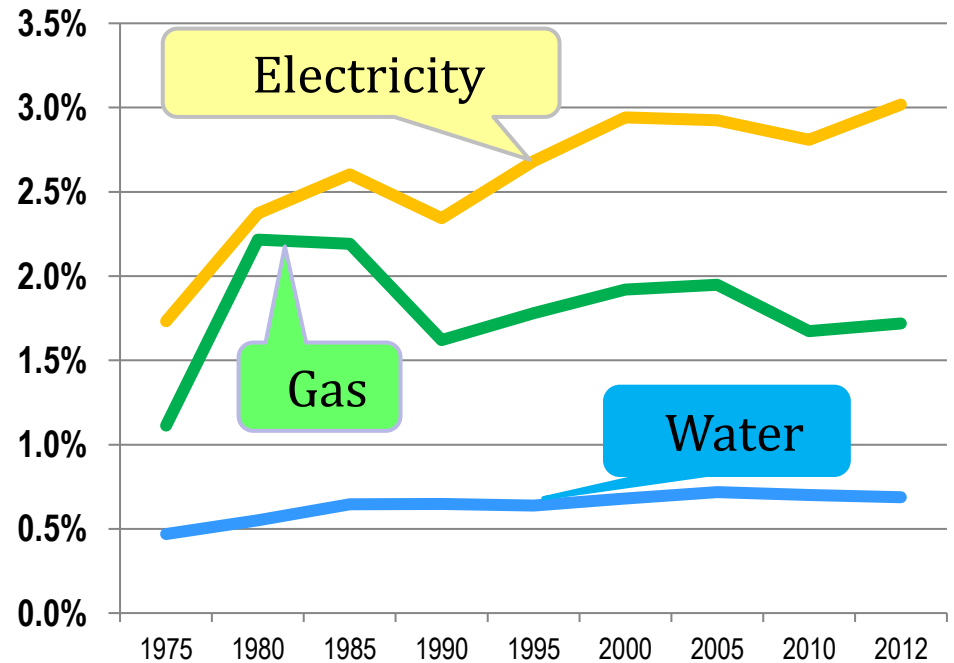
# 9. Affordable Drinking Water

## (1) Consideration for the Low-Income Group

### Affordability



- “**Minimum volume**” with minimum rate, a cross-subsidy.
- Reduction and **exemption** as a welfare policy of the local government.
- **Installment plan and funds** for subsidizing connection charge in the past.



Percentages of water, gas and electricity tariffs in average monthly living expenses

# 10. Engaging Local Communities

## (1) Participation of Residents

Local residents **contributed funds and labor**, in developing rural water supply systems.



**Public consultations, customer satisfaction surveys, supporters system** (monitoring system by customers), etc.

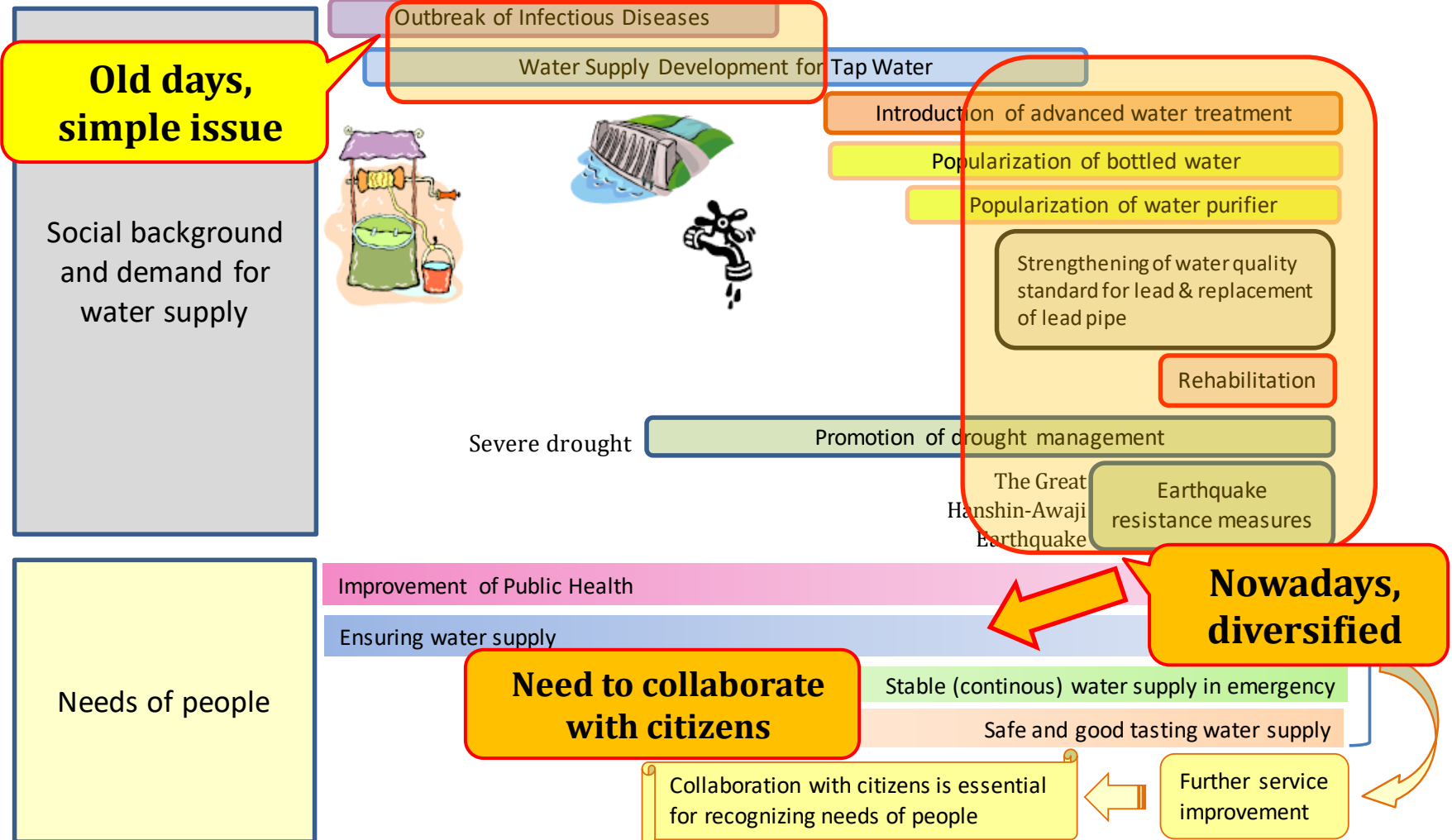


**Villagers working in rural water supply development.**

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

# 10. Involving Local Communities

|                            | 1940s | 1950s | 1960s | 1970s | 1980s | 1990s | 2000s | 2010s |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| water supply coverage rate |       | 26.2% | 53.4% | 80.7% | 91.5% | 94.7% | 96.6% | 97.5% |



Source: Ministry of Health, Labour and Welfare, <http://www.mhlw.go.jp/stf/shingi/2r98520000027cq9.html>



# 11. Lessons Learned (1)

- **(Legal Framework for Universal Access)** The national government established the **legal frameworks** to support utilities in **securing funds** and in **standardizing technical requirements** in developing water supply system. Utilities could issue **public enterprise bonds** for long-term financing. Small utilities in rural areas could not recover the cost with their operation and utilized **national subsidies** for facility construction.
- **(Water Resources Development)** The national government established **an organization responsible for multi-purpose dam constructions and coordination of dam users**. By sharing both the costs and benefits of dam construction, the financial burden for each water utility was reduced. **Measures and new laws to improve and protect raw water quality**, have helped to restore water quality.

# 11. Lessons Learned (1)

- **(Safe water supply)** To operate a stable supply of good quality water for 24 hours a day, the national government established **water quality standards**. Water utilities are responsible for implementing **water quality analysis**, and made efforts to **secure quality pipe materials and equipment**. The JIS and other standards, and JWWA inspection played key roles to guarantee the quality of pipe materials and equipment.
- **(Maintenance for Stable Water Supply)** **Preventive maintenance** is very important for a stable water supply. Accidents can be prevented by analyzing **data and information of daily inspections, operation, and repairs**. **Information and knowledge sharing** by **manual** and **OJT, regulations** and **guidance** by the national government played an important role for the prevention of accidents and problems.

# 11. Lessons Learned (2)

- **(Leakage Control)** The average **leakage** rate in Japan is 4.7%. The dramatic drop from 70-80% after the war was the result of corrective and preventive measures implemented after experiencing severe droughts and water scarcity. These include **detection** and **repair** of leaking pipes, **replacement** of aging pipes and installation of new pipes with **better materials** and **improvement of pipe connections** and **construction methods**. Pipe networks organized in **distribution blocks** facilitates the leakage reduction activities.
- **(Sustainable Management)** **Self-supporting accounting system** and **cost recovery** have been essential for sustainable management. Utilities are required to prepare a **financial plan**, clearly describe future conditions demonstrate efforts for cost reduction. **Master plans**, **business plans** and **PDCA cycle** are important tools for sustainable management.
- **(Affordable Tariff)** **Minimum rates including minimum water** are set relatively low making it affordable for low-income group. The progressive rates allocate more financial liabilities to high-volume users (**a cross subsidy**). Low-income group can apply for **tariff reductions or exemptions**.

# 11. Lessons Learned (3)

- **(Training of Utilities' Staffs)** The National Institute of Public Health developed the **human resources** required to establish the nationwide water supply system. Utility workers were trained through **OJT** and attended **training programs** conducted internally. JWWA organizes seminars and committees for **knowledge sharing** and **professional development**.
- **(Public Relations)** **Public relations activities** and mechanisms for **public participation** are important to building mutually supportive relationship between the utility and its customers. Staff of each utility understand that customers' willingness to pay is directly related to their level of **satisfaction with the quality of service**. Maintaining **trusting relationships** with customers is a very important component of the water supply service.