# Chapter 8
# Concluding Remarks and Water Demand Management Measure Overview


## 8.1 Concluding Remarks

WDM has a critical role to play in securing future water supplies. The management of water resources in cities globally has changed in recent years, due to rapid population growth, urbanisation, rising living standards, and impacts of climate change. This has resulted in the need to develop more sustainable and efficient urban water systems worldwide, with urgency.

Water management is dependent on the stage of development of the countries, legal and institutional frameworks, and institutional and financial capacities, among others. Given the current level of water consumption in urban areas, it will become increasingly challenging to manage water demand, unless cities are able to address current water challenges. These challenges include but are not limited to, increased water demand, growing competition between water users, water scarcity and pollution, inefficient water supply systems, and climate change impacts (Arfanuzzaman and Rahman 2017). Hence, the roles of water conservation and water demand management (WDM) measures are crucial in all spheres of the water sector (Kayaga and Smout 2011).

This guidebook is based on an extensive documentation review and synthesis of urban WDM policies and practices both in ASEAN, with international examples. It is designed to be an accessible resource for stakeholders, such as policymakers and practitioners, to assess and implement water demand management strategies and initiatives and promote knowledge transfer among ASEAN countries.

The guidebook draws upon notable WDM practices and policies, which have demonstrated effective demand management outcomes. The guidebook follows a WDM typology developed by the authors and comprises 47 indicators, further classified into three different categories of WDM applications, namely (1) water losses; (2) economic instruments; and (3) non-price mechanisms.

The guidebook recognises the efforts of ASEAN countries in initiating several WDM strategies and planning efforts. As large proportions of water loss in distribution networks are one of the main challenges that water service providers face



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in ASEAN, all countries in the region have implemented several NRW management strategies to overcome this concern. Strategies include NRW monitoring, leak detection, and pipe replacements. Within ASEAN, Metro Manilla (the Philippines), Singapore, Jakarta (Indonesia), and Johor (Malaysia), in particular, have been leading protagonists of investment in technologically advanced leak detection equipment and surveillance systems, which have contributed to significant improvements in NRW levels.

As low public awareness of water conservation continues to impede the objective of water-use efficiency, all ASEAN countries have invested in improving public communication and outreach as part of their WDM strategies. Since public campaigns and education programmes focus on behaviour changes, their impacts on water-use efficiency are often difficult to quantify and assess (EEA 2017). Nonetheless, they are both acknowledged as highly useful non-price mechanisms that governments and water service providers adopt (Booysen et al. 2019; Matikinca et al. 2020; Tortajada et al. 2019). In Malaysia and Singapore, campaigns that aim to influence water-efficient behaviours are further bolstered by supportive infrastructure, devices, and initiatives, which include water-saving devices, retrofits, outreach and communication through utility bills, and labelling schemes. Such measures have consistently proven effective in reining in water demand in many countries, including Singapore and Malaysia.

ASEAN countries may strengthen WDM management further by adopting cutting-edge technologies to manage water demand more efficiently, such as smart meters, smart DMAs, and other novel devices for leakage detection and management. They may review their tariff levels and structures to improve cost recovery, which is important as tariffs serve as a primary means for service providers to generate revenue and cover costs for water service provisions (Damkjaer 2020). Underpricing water may also inadvertently contribute to overconsumption and inefficient water usage (Bello-Dambatta et al. 2013; EPA 2016).

Policy and regulatory measures, as well as technical and institutional measures, are necessary components to each country's WDM efforts. A summary of these measures, for consideration by ASEAN leaders who oversee WDM efforts in their respective countries, is as follows:

(i) **Policy and regulatory**

- Water demand management can be made a priority issue at all levels of governance—regional (ASEAN), national, and local (and the priority of the local communities) through the development and implementation of coherent regional, national, and local water demand management policy frameworks.
- Encourage efforts at all levels (regional, national, and local) to promote water demand management through various policies and water demand strategies (e.g. tariffs and non-price mechanisms).
- Establish the importance of effective water demand management and the need to conserve water resources to help implement the plans for each ASEAN country, which could address broader environmental and development goals (e.g. UN Sustainable Development Goals).

- Ensure that legal and institutional frameworks possess the jurisdiction to enforce the implementation of national and local water demand management policies and strategies into actionable plans.
- Ensure that national plans/strategies incorporate achievable water demand management targets, which can be transposed into local water demand management plans and programmes.
- To support such policies and strategies, various regulatory, social, and economic instruments may be implemented, to ensure compliance by all stakeholders.

(ii) **Technical and institutional**

- Efficient and transparent institutional arrangements can be established in countries and city to identify and address limitations in service delivery. This can help improve organisational efficiency and encourage inter-departmental/agency cooperation. For instance, an independent national body such as a department of Water Demand Management with clear roles and responsibilities can be established.
- Decentralisation: Empower mid-level staff of water service providers to plan and implement WDM strategies.
- Smart and 'green' cities that formulate and implement efficient, innovative water demand management measures can be rewarded.
- Establish and maintain national water demand management statistics, which can be shared with all stakeholders so that they benefit from the shared knowledge. To achieve this, assessments and studies of all aspects of water demand management (e.g. residential and non-residential water consumption rates, rate of physical losses, and benefits of greywater recycling) may be conducted.
- Research and share information on the development of innovative and emerging water demand management technologies.

*Sources* Araral (2010), Rivera (2014).

## 8.2 Water Demand Management Measure Overview

A brief overview of key WDM measures and notable examples of implementation in ASEAN countries that are explained in greater detail in the guidebook can be found in Table 8.1.

**Table 8.1** Key water demand management measures and notable examples

| Key WDM measures | Description | WDM indicators | Notable examples in ASEAN | Section |
|---|---|---|---|---|
| Water losses:<br>NRW management | Water loss is defined as the difference between water pumped into the system and billed water. The volume of water lost depends largely on the quality, maintenance, and approach to active leakage control of the water distribution network. The volume of water lost before reaching water users is referred to as non-revenue water (NRW) | Measures aimed at reducing the treated water loss in the distribution system. E.g<br>– Leakage/NRW reduction target and monitoring mechanism<br>– Leak detection<br>– Pipe repair and replacement<br>– Pressure management<br>– Technology usage for leak detection and repairs | *Cambodia*<br>PPWSA significantly reduced NRW from 72% in 1993 to approximately 9.78% in 2020. It implemented measures such as leakage repair and replacement, metering, and programmes to identify illegal connections and suspension of supply for non-payment<br>*Indonesia*<br>PALYJA and Aetra installed automated leak detection systems in 2016 to provide early warning alerts for potential leakages. In that time, 450 sensors, using AQUADVANCED technology, have detected 10–20 anomalies per day in the water distribution system<br>PALYJA and Aetra also introduced DMAs to improve leakage detection. As of 2014, PALYJA had established 95 DMAs and aimed to build 52 more DMAs. Similarly, Aetra established 174 DMAs by 2013. As a result of DMA creation and leakage detection systems, 35,916 leakages were detected by PALYJA in 2016. This represented a 28% increase in leakage detection from 2015 (28,067 leakages). Meanwhile, Aetra increased leakage detection from 22,932 leaks in 2015 to 25,587 in 2016 (Aetra 2016)<br>*Malaysia*<br>Ranhill created SMART DMAs with semi-permanent noise loggers and correlations technology. The results from the initial installation (SMART DMA trial) of 295 noise loggers in Bandar Putra indicated a 35% reduction in NNF from 30.99 to 20.08 L/s within three months<br>SPAN requires its water operators to meet standards for water pressure in landed and vertical buildings in its uniform technical guidelines for water reticulation and plumbing<br>*The Philippines*<br>Manila Water in Metro Manila: NRW reduction efforts helped reduce the NRW rate from 23.9% in 2007 to 10.4% in 2019 and the recovery of nearly 750 million litres per day MLD<br>Maynilad: NRW reduction efforts helped reduce the NRW rate from 67% in 2007 to 25% in 2019 and helped to recover 979 MLD<br>*Singapore*<br>The PUB conducts regular leak detection tests using advanced technologies. Its intelligent water management system (IWMS) permits real-time monitoring of water assets across the network and provides a comprehensive set of readings for timely action<br>*Thailand*<br>MWA has reduced water losses by replacing damaged pipes and installing new pipes where required, resulting in a water loss reduction of 1.92% (since 2017), with a water loss rate of 29.83% in 2018 | 5 |

(continued)

**Table 8.1** (continued)

| Key WDM measures | Description | WDM indicators | Notable examples in ASEAN | Section |
|---|---|---|---|---|
| Water losses: commercial losses | Commercial losses, also known as 'apparent losses' or 'administration losses', are the water losses that occur in the distribution system and which are not paid for by the water consumer. Commercial losses can be the result of customer meter under-registration, data handling and billing errors, unauthorised use, or theft | Measures to reduce loss in revenue. E.g.:<br>– Programmes to identify, remove, and replace illegal connections<br>– Suspension and legal measures for non-payment<br>– Meter replacement and upgrading<br>– Programme to reduce meter tampering<br>– Repairing the sites of leakages<br>– Individual household metering | *Malaysia*<br>SPAN's 7-year programme in Malaysia has set a 1% target for commercial losses. In addition, Ranhill SAJ (Johor's water utility) has added 38 staff to its newly established enforcement and preventative section in the customer service department. Ranhill SAJ also undertook an extensive water meter upgrading and replacement programme<br>Ranhill SAJ has also put the following sanction mechanisms in place:<br>– Any outstanding bills must be settled within 30 days, or else a disconnection notice will be issued<br>– The deposit might be deducted to settle outstanding bills<br>– The water licensee has the right to carry out suspensions and deduct deposits<br>*Cambodia*<br>PPWSA runs an internal education programme to educate PPWSA workers to ensure that they do not breach rules (e.g. facilitating the installation of illegal connections). Staff members who are involved in such activities are fined.<br>Water supply suspensions are imposed on customers who do not pay their bills. PPWSA issues a warning and gives the customer a 15-day grace period. If the customer still does not pay, he/she is disconnected from the water supply network. To regain access, customers must pay the outstanding amount, a penalty amount of 1%, and a reconnection fee of 60,000 KHR[1] | 5 |

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[1] KHR 1 = USD 0.000246.

**Table 8.1** (continued)

| Key WDM measures | Description | WDM indicators | Notable examples in ASEAN | Section |
|---|---|---|---|---|
| Economic instruments | Economic instruments are targeted at customers to motivate desired decision-making and directly influence their water consumption behaviour. This may be achieved by offering financial rewards (rebates and tax credits) for desired actions and/or penalties (penalties and fines) to deter undesirable behaviour | Monetary incentives to encourage water-saving behaviour among users. E.g.:<br>– Tariff structure<br>– Rebates/incentive schemes for consumption reduction through water bill<br>– Fines for excessive use | *Singapore*<br>Tariffs are based on volumetric consumption, covering the total cost of production and supply. Additionally, Singapore charges both a Water Conservation Tax (WCT) to encourage water conservation and to reflect the incremental costs of additional water supplies, as well as a waterborne fee (WBF) to recover the costs of used water treatments and to maintain the used water network. eligible HDB households receive between SGD 220 and SGD 380 in U-Save rebates on average per year<br>*Indonesia*<br>The national government imposes sanctions for non-payment, including fines and supply suspensions, under Government regulation No.122/2015 on water system provision<br>Local governments and state-owned water utilities can issue fines imposed for non-payment. These measures may have contributed to a slight increase in water bill payment rates from 93.28% in 2018 to 93.67% in 2019<br>PALYJA and Aetra have also imposed tough sanctions on those not paying their water bills on time by temporarily disconnecting their water and levying fines<br>*Malaysia*<br>In Penang, the water utility PBAPP has implemented a corporate social responsibility programme to ensure that tariff reviews do not disadvantage low-income households. The programme costed PBAPP RM[2] 16,482 in 2017 and reached 199 families who earned RM790 per month or less<br>In Johor, Ranhill has implemented a water rebate programme that provides free water to needy households for the first 25 $m^3$ of water consumption. In 2019, 3136 low-income households benefited from this programme<br>*The Philippines*<br>The private concessionaires Manila Water and Maynilad have a 'socialising' pricing scheme in place to ensure affordability for households. Manila Water provides a discounted charge of PHP 83.14[3] to low-income households with water usage of less than 10 $m^3$ per month<br>*Thailand*<br>The Water Resources Act (2018) imposes fines for excessive water use during periods of water rationing, as droughts could inflict severe national socio-economic and hydrologic damage. Individuals who do not comply may be imprisoned for up to a year or receive a fine of up to ฿100,000,[4] or both | 6 |

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[2] RM 1 = USD 0.24.

[3] PHP 1 = USD 0.02.

[4] THB 1 = USD 0.030.

**Table 8.1** (continued)

| Key WDM measures | Description | WDM indicators | Notable examples in ASEAN | Section |
|---|---|---|---|---|
| Non-price mechanisms | Non-price measures refer to non-economic tools implemented by water utilities and governments that seek to control the water consumption levels by restricting water usage and/or altering water-use practices and habits, rather than by influencing the price of water | Non-price mechanisms that directly affect water consumption. E.g.:<br>– Restrictions for water-specific uses<br>– Water-saving devices and labelling schemes<br>– Public campaigns and school curriculum<br>– Water efficiency audits<br>– Outreach and communication through utility bills<br>– Water efficiency benchmarking (household/residential)<br>– Water efficiency benchmarking (non-residential/industry) | *Brunei Darussalam*<br>Both public campaigns and school education programmes are in place, with green school programmes teaching school children the importance of water conservation. The department of water services also publishes posters and pamphlets on water conservation to educate residents<br>*Indonesia*<br>PALYJA and Aetra have employed public outreach strategies via online and offline platforms. In 2016, PALYJA reported a relatively high customer satisfaction rate of 82%, while Aetra attained a comparable 85.43% in 2018<br>ATB has launched a mobile phone application that provides customers with detailed bills, which includes their monthly water consumption trends. ATB has also devised a minimum water bill scheme where customers are charged a minimum of 10 $m^3$ worth of water consumption should their monthly usage level fall below that threshold<br>Aside from public outreach through online and offline platforms, PALYJA and Aetra have utilised various payment channels, ranging from post office to e-commerce platforms that allow customers to pay their water bills<br>*Laos*<br>NPNL launched a mobile application, 'Nampapa Nakhone Luang App', which provides customers with detailed information on their monthly bills and consumption trends of the past three months<br>*Malaysia*<br>Malaysia introduced the water-efficient products labelling scheme (WEPLS) in 2013. As of 2018, WEPLS applied to five products, namely water closets, clothes washing machines, showerheads, water tap, and urinals, sold by 25 suppliers across 37 brands and 288 models<br>*The Philippines*<br>The water district of Zamboanga City has established an independent water audit team to identify anomalies in water usage and conduct water audits. They have also developed water audit manuals and conducted audit training for the commercial sector. In 2016, ZWAT also completed a four-day onsite water audit training for various commercial establishments<br>*Singapore*<br>The WELS introduced in 2006 was made mandatory in 2009. The scheme contributed to significant water reductions in water consumption. Water consumption declined from 155 L/day in 2009 to 143 L/day in 2017<br>*Thailand*<br>The MWA regularly conducts activities to support youth networking and raise awareness about water conservation, water treatment processes, and water-quality standards. The 2016 'Water Conservation Camp' emphasised water savings and included training in basic pipe repair with local schools. By 2017, 48 schools from the Mae Khlong and Chao Phraya River basin communities attended the camp, with approximately 40 students per school | 7 |

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