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Water demand management in Selangor - why and how?

by

James T. Cherian

**Center for River Basin Organizations and Management,
Solo, Central Java, Indonesia**

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The author:

James T. Cherian, Clean Production Adviser, Malaysia
tansencherian@yahoo.com

CRBOM
Center for River Basin Organizations and Management,
Solo, Central Java, Indonesia
www.crbom.org
info@crbom.org

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This paper has been extracted from the comprehensive report '*The need for a water demand management plan for Selangor (and a golden opportunity)*', prepared in June 2009 by Malaysian Nature Society, Selangor Branch, in partnership with stakeholders, NGOs and professionals.

Summary

In order to manage our water and water-dependent resources in a sustainable way, it is vital to develop the knowledge and soft skills that is necessary to safeguard our catchments and river basins from water sullyng socioeconomic activities and to attenuate our demand for water.

Water demand management (WDM) is an essential part of the challenge to sustain our water resources. The principle that underlies WDM is '*efficient use of water in order to maintain vital environmental flows and to reduce dependence on costly infrastructure projects*'.

The present paper presents a study of water demand management in Selangor conducted in 2008-09. The study identified 10 recommendations that were regarded as useful and practical, and suitable for implementation within the existing institutional and legislative framework. It is believed that between them, by 2020, the proposed measures can reduce the total demand of water by around 20 percent as compared with a scenario without demand management.

Acronyms and abbreviations

IWRM:	Integrated water resources management
LPD:	Litres per person per day
MLD:	Million litres per day
MYR:	Malaysian ringgit. 1 MYR is roughly around 0.3 US dollar (by mid 2009)
NRW	Non-revenue water
O&M:	Operation and maintenance
WDM:	Water demand management

Glossary

Demand management: Intervention in order to balance the availability and demand of water, by reducing the demand (of households, industries, farmers, and other consumers).

Demand management is applied in order to save water and/or save money for infrastructural development, and/or to improve the water efficiency

Efficiency improvement: The over-all water efficiency is the production per unit of water. The distribution efficiency is the ration between water supplied and raw water withdrawn. Improvement of water efficiency comprises reduction of any unnecessary losses and waste (during storage, distribution or consumption). This can be achieved (for example) by appropriate operation and maintenance (and rehabilitation if required), and/or by introduction of new technology in agriculture and industry

IWRM (integrated water resources management) (as defined by Global Water Partnership): A process which promotes the co-ordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems

Supply enhancement: Intervention in order to balance the availability and demand of water, by making more water available (to households, industries, farmers, and other consumers). This can be done by infrastructural development (of waterworks, distribution systems and irrigation systems), and/or by storage (in reservoirs), and/or by using new raw water sources. Supply enhancement requires raw water and money.

Water use (or consumption, or utilisation) is the part of the demand that is actually served at a given time. The use of water (by households, industries, farmers, and other consumers) can be increased by infrastructural development and reduced by demand management

1 Introduction

Water demand management can save water and money at the same time. When implemented gently and prudently, water demand management can contribute to sustainable resource utilisation as well as financial sustainability of the water supply and sewage disposal infrastructure.

The present short paper describes the potential benefits of water demand management in Selangor, Malaysia¹. It is extracted from a comprehensive study conducted in 2008-09 by Malaysian Nature Society, Selangor Branch, in partnership with stakeholders, NGOs and professionals. The extract has been prepared for the sake of regional knowledge-sharing, with a particular view to readers outside Selangor.

2 Basics

Demand management tools

The demand of water for *domestic consumption* can be controlled by measures such as

- installation of water meters (if not done already), and charging a water fee;
- applying different tariffs for different housing areas;
- generation of awareness about prudent use of water; and
- rationing of water (normally in case of critical shortage only).

The demand of water for *industrial consumption* can be controlled by measures such as

- installation of water meters (if not done already), and charging a water fee;
- applying different tariffs for different users and different seasons;
- promotion of new, water-efficient technology; and/or
- rationing of water (normally in case of critical shortage only).

The demand of water for *irrigation* can be controlled by measures such as

- charging a water fee that depends on the volume of water used (rather than the irrigated area);
- applying different tariffs for different seasons;
- generation of awareness about prudent use of water;
- promotion of good operation and maintenance;
- promotion of new, water-efficient technology (crops and cultivation routines); and/or
- rationing of water, possibly by de-central administration (water user groups).

¹ Please note that in this paper, '*Selangor*' is the state of Selangor as well as the federal territories of Kuala Lumpur and Putrajaya (both of which are entirely surrounded by the state)

Advantages of demand management

- Low investment required (except for repair of distribution network, which can be very expensive)
- Public income can be generated by water fees
- Incentive to industries and agriculture to improve their efficiency (and thereby their competitiveness in an open market)
- Raw water is preserved for alternative uses downstream, including fisheries
- Less sewage treatment capacity required

Disadvantages of demand management

- Excessive demand management can affect general economic development, and national competitiveness and employment
- Risk of adverse social impact to the poor part of the population

The negative effects of demand management will be less if regulation is introduced gradually, by small steps, in a transparent, predictable and socially balanced way.

Advantages of increased supply

- General economic development can proceed unaffected
- Scope for serving all users with adequate water
- Basis for increased turnover (and income generated) for water supply and sewage disposal utilities

Disadvantages of increased supply

- Capital investments required for water treatment and distribution, as well as sewage and sludge disposal
- Opportunity costs - the net consumption of raw water becomes unavailable for other useful purposes
- Risk of adverse environmental impact related to (i) increased withdrawals and (ii) increased sewage discharges

3 Water management in Selangor

Today in Selangor, the demand of raw water exceeds the availability. In response, the interstate Pahang-Selangor Raw Water Transfer Project is planned, with an estimated cost of 9 billion MYR, to supply 1900 MLD. It will be Selangor's third mega water project undertaken in the last 12 years.

Water demand management appears as a golden opportunity. The domestic water withdrawal is the highest in SE Asia, with a rate that is more than double of the 100 LPD that can be regarded as '*best practice*'. Selangor's water crisis is an opportunity to develop and showcase expertise on dealing with the planet's most critical resource. In addition, water is the ideal first natural resource, which the public should learn to care about both in terms of volume consumed and protecting our freshwater resources from polluting activities.

Figure 1: Domestic water withdrawals (2002)

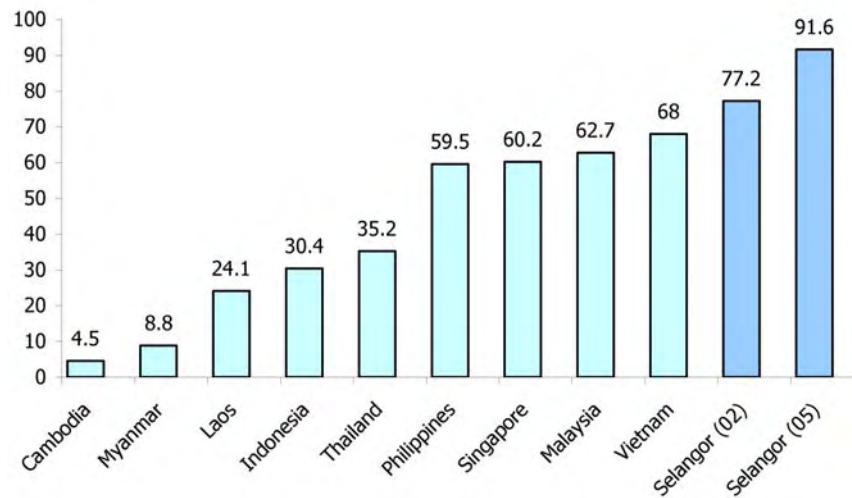


Table 1: Water use in Selangor (2006)

Water withdrawn	4,600 MLD	(120%)
Production	3,800 MLD	(100%)
Non-revenue water	1,380 MLD	(36%)
Domestic consumption	1,460 MLD	226 LPD (39%)
Non-domestic consumption	930 MLD	144 LPD (25%)
Population	6,470,000	

High volume non-domestic users may include industries, commercial operations, government buildings, hospitals, shopping centers, hotels, golf courses, mosques, churches, universities and schools. A small percentage of customers likely account for half the water demand in the non-domestic sector.

The water tariff is purely volumetric, which doesn't fit the costs well, considering that water supply costs are partly fixed and partly variable. A progressive rate is applied, with three step steps for residential and two flat steps for non-residential uses, as shown in the table below. In 2008, the basic rate for domestic uses was reduced from 0.57 MYR/m³ to nil.

Table 2: Water tariffs (2009)

Volume used	Residential	Industrial/commercial
0-20 m ³ /year	0.00 MYR/m ³	2.07 MYR/m ³
21-35 m ³ /year	1.03 MYR/m ³	2.07 MYR/m ³
> 35 m ³ /year	2.00 MYR/m ³	2.28 MYR/m ³

Revenues do not cover O&M costs, not to speak of capital costs. The deficit (in 2006) was 0.26 MYR per m³ sold, excluding capital costs.²

² Note from the editor: Balance between revenue and costs is merely an indirect indicator of medium-term financial sustainability. There is no rule that such a balance should be observed;

Selangor's production costs (of 1.24 MYR/m³) is much higher than other Malaysian states³, whose average cost of production is about 0.55 MYR/m³. The higher cost of production is thus a significant factor contributing to the deficit. Despite water being sold in Selangor at a higher price (1.70 MYR/m³) than all states but Johor and Melaka, it is not sufficient to overcome the deficit. The reason for Selangor's high cost of production merits investigation. For instance, if the quality of raw water is low, the cost of treatment is higher. It is also possible that the cost of production is higher because it embeds some capital costs.

Adding to the cost of production or loss in revenue is the large volume of non-revenue water (NRW), which for Selangor was 37% of total production (2006). This raises the cost of water sold to 1.96 MYR/m³. This NRW level falls in the mid-range of states in the Peninsula, but when measured in litres per km pipeline per day, water lost in distribution in Selangor (70,000 l/km/d) was almost double that of the weighted average of all other states (of 36,000 l/km/d)⁴. Generally, this is considered a better measure for NRW than a simple percentage representation. If Selangor could achieve an NRW around 36,000 l/km/d, NRW would be about 20%.

4 Benefits of demand management

Basic analysis

For domestic water uses, we may draw a lesson from targets being attempted or achieved elsewhere. Australia's Capital Territory set a target to reduce per capita consumption of mains water 12 per cent by 2013 and 25 per cent by 2023 (base year 2003). In Singapore, domestic water consumption was 172 litres per person day in 1995. By implementing a range of demand management measures, this was reduced 9 per cent to 156 litres by 2008⁵.

As a vision of how we wish to express stewardship for our water resources, what should we aim to achieve in Selangor, say by 2020, at least for the domestic demand?

A third '20' seems to suggest itself and perhaps this may be adopted, i.e. reduce water use 20% by 2020.

The latest consumption figures may be used as a baseline. According to the Water Industry Guide, domestic demand was 244 LPD (litres per person per day) in 2005 and 212 LPD in 2006. It is likely that this apparent sharp drop is the result of an accounting anomaly rather than actual drop in consumption. If Selangor's population in 2006 was 6.47 million and domestic demand was 1459 MLD⁶ then average domestic consumption would have been 226 LPD. Taking 20% off this amount would result in a figure of 181 LPD. This target may be deemed achievable given the potential for demand reduction of the recommendations in this proposal as well as other measures that may be applied in the future and the levels already achieved in many countries.

but subsidies or profits should be visible. Somebody needs to pay - and if there is a surplus, any government is always in need of revenue, for many good purposes

³ (Excluding Sabah and Sarawak, with their vast areas and lower population density)

⁴ Malaysian Water Association, 2008

⁵ Koh, M (2009)

⁶ Malaysian Water Association (2008)

For high volume users in the institutional, commercial and industrial sector, water efficiency plans will help to address and reduce demand in a comprehensive way. Besides large factories, schools, universities, hotels, shopping centers, office buildings, golf courses, hospitals, nursing homes, and mosques have considerable potential to reduce water demand. A Water Demand Management Plan will help this sector reduce demand compared to the 'do nothing' scenario.

The same goal of a 20 % reduction can be set in terms of average usage by non-domestic customers. Usage levels can be compared against benchmarks. While overall demand may still increase due to economic growth, the water would be shared by a greater number of beneficiaries (customers).

According to the Water Industry Guide 2007⁷, for the non-domestic sector, average consumption per account was 98 m³ per month in 2005 and 125 m³ per month for 2006⁸. Again, this sharp rise may be due more to an accounting anomaly and not to actual change in usage trends. Nevertheless, one may accept the higher number as a baseline figure. For non-domestic consumption in 2020 one can assume that it will reach and stabilize at the current (2006) average for Penang (157 m³ per month). A 20% reduction achieved through WDM would result in 125 m³ per month (average consumption per month per account). This figure happens to be the same figure for 2006.

Proposed WDM targets for Selangor

Based on the foregoing analysis, the proposed WDM goals are summarized below.

Table 3: WDM Goals for 2020

1	Reduce domestic sector demand to 181 LPD or less
2	Maintain average non-domestic demand at 125 m ³ per month per account (or 144 LCD)

Demand management initiatives

The following recommendations are regarded as useful and practical, and suitable for implementation within the existing institutional and legislative framework⁹.

- 1 Require installation of water efficient toilets (minimum rating – dual flush of 6 and 3 litres) and plumbing fixtures in all new homes and buildings and for major renovations.
- 2 Undertake to provide and install water saving bags, constant flow regulators and thimbles.
- 3 Initiate, state-wide, a voluntary water efficiency certification and labeling scheme for plumbing fixtures and washing machines, and maintain a registry of water efficient products.
- 4 Offer a 100 MYR rebate to replace an inefficient toilet with a high efficiency toilet and a maximum rebate of 200 MYR per home or approved establishment for 100,000 units.

⁷ Malaysian Water Association (2008)

⁸ (Same)

⁹ In Malaysia, the sewage tariff is under federal jurisdiction. Therefore, it has not been considered in this study. In general, a sewage tariff and a water fee would have an identical effect on the behaviour of water users (provided that both are volumetric). (Today, a flat fee is charged per household)

- 5 Offer a 100 MYR rebate, one to a home, to purchase a water (and energy) efficient washing machine for 100,000 units.
- 6 Require high volume users to develop and implement a Water Efficiency Plan.
- 7 Conduct Training to assist high volume users implement a Water Efficiency Plan.
- 8 Apply a two-part tariff consisting of a fixed charge and a volumetric charge, where the price structure reflects full cost based on marginal costing and includes an adequate raw water charge.
- 9 Clearly communicate customer's marginal price information and the block rate structure in the water bill.
- 10 Institute a WDM agency to implement above (and future) measures, and carry out all supporting activities by actively engaging the public and stakeholders.

A summary of the cost and impact of each recommendation is shown below.

Table 4: Costs and impacts of recommended demand management initiatives

No.	Initiative	Cost <i>mio. MYR</i>	Immediate saving <i>mio. l/day</i>	Long-term saving <i>mio. l/day</i>
1	Water efficient toilets	(included in no. 10)	17	170
2	Water saving implements	2	10	10
3	Promote water-efficient products	(included in no. 10)	(some)	100
4	Subsidize replacement of toilets (100,000 units)	10	10	10
5	Subsidize efficient washing machines (100,000 units)	10	13	10
6	Require high volume users to develop and implement a Water Efficiency Plan	(included in no. 10)	(some)	350
7	Training to support Water Efficiency Plan implementation	(included in no. 10)	(complements no. 6)	(complements no. 6)
8	Supportive tariff, full cost recovery and raw water charge	(included in no. 10)	(depends on increase)	> 100
9	Communicate prices	negligible	(some)	(some)
10	A WDM agency	5 (per year)	(supports all of above)	(supports all of above)
	Total	5 (per year)	> 50	> 750

Expected benefits

The water demand for 2020 can be compared for two scenarios, the 'do nothing' scenario (i.e. no WDM) and another with WDM.

For the number of non-domestic accounts, one can assume the same growth rate as occurred between 2001 and 2006, that is 3%. This would then result in 345,000 non-domestic accounts in 2020. The forecast population in 2020 for Selangor (including

Kuala Lumpur and Putrajaya) is 8,850,000¹⁰. The scenarios are presented in the table below along with actual figures for 2006.

Table 5: Water demand scenarios for 2020 without and with WDM

	2006 a)	2020 without WDM	2020 with WDM
Population	6,470,000	8,850,000	8,850,000
Non-domestic accounts	226,554	354,000	354,000
Domestic consumption	226 LPD	226 LPD	181 LPD
Non-domestic consumption	125 m3/month/account	157 m3/month/account	125 m3/month/account
Domestic demand	1,460 MLD	2000 MLD	1600 MLD
Non-domestic demand	930 MLD	1780 MLD	1420 MLD
Total demand	2,390 MLD	3,780 MLD	3,020 MLD
NRW	37%	15%	15%
Total supplied	3,780 MLD	4,440 MLD	3,560 MLD
Capacity	4,480 MLD	n/a	n/a

a) All figures in this column except population are from Malaysian Water Association (2008)

Two points are noted from the table:

- 1 Even with a 52 % growth in non-domestic accounts and a 25% higher average consumption in the sector, and the higher forecast population, and with no WDM but a reduced NRW of 15%, 2006 capacity would suffice for 2020 although barely.
- 2 The WDM scenario, allowing for a 52% growth in non-domestic accounts but by maintaining average consumption at the 2006 level, and achieving a 20% reduction in domestic consumption compared to 2006, can actually result in a 6% less overall consumption as compared with 2006.

Implementation

Before full implementation of some of the recommendations, a pilot program would be useful for developing a 'well-tuned' state-wide program.

Data and feedback has to be collected throughout the course of implementation in order to assess program effectiveness. The program can be refined over time to ensure that program goals are met.

Particular attention must be paid to the characteristics, needs, and preferences of water users. Partnerships with other government agencies, community groups, stakeholders, academics, civil society and the media should be vigorously pursued.

¹⁰

5 Success factors

Determinants of success of WDM

Certain organizational features are fundamental to the success of water demand management. Keyes et al (2004) conducted a study of several water jurisdictions and found that successful demand management programs shared all seven of the following characteristics:

- 1 Political leadership,
- 2 stakeholder involvement in planning and implementation,
- 3 a detailed policy outlining goals and conservation measures,
- 4 detailed water use data, demand forecasting, and monitoring,
- 5 stable funding sources for water conservation measures,
- 6 sufficient staff and technical assistance to implement the program, and
- 7 broad-based education and outreach.

The need to engage stakeholders

Stakeholders support can be regarded as a critical pre-requisite towards realising WDM.

Building support for WDM requires raising stakeholders' awareness on the water resource problems and understanding of the consequences of continuing with supply driven management as opposed to a demand driven approach. A first step in engaging stakeholders is identifying those

- that will be affected by or benefit from the interventions;
- that could influence and contribute to the process as change agents towards achieving the desired outcomes.

It is envisaged that the **key stakeholders** to be targeted in the case of Selangor would include the following: Policy and decision makers, the civil service, media, the business community, community groups, religious leaders, schools – both teachers and students, and NGOs.

Dialogue must be actively sought and maintained with **peak industry associations and professional bodies** such as Real Estate and Housing Developers Association (REHDA), Institute of Engineers Malaysia (IEM), Persatuan Arkitek Malaysia (PAM), Malaysian Institute of Planners, Federation of Malaysian Manufacturers and Malaysian Retailers Association to advance the goals of WDM and sustainable use of water resources in general.

In Malaysia, **religious leaders** reach large numbers of people and exercise considerable moral authority over their faith community. It is vital to win their support.

Support of **multinationals and large local companies** can be solicited for the WDM Plan through their customer service programmes. For example, some of the leading washing machine brand companies may agree to take up the tab for the proposed rebate scheme.

Useful vehicles for engaging stakeholders include workshops, forums, one-to-one meetings, cascade briefings, obtaining slots on the agendas of existing meetings and conferences.

Outreach to community groups

Community groups may be categorised according to criteria such as social values, business, religious, origin, interest, gender, age, level of education and geographical locality. The approach for reaching out to the various community groups would need to be tailored accordingly to appeal to the respective target audience.

In Selangor, one of the key community groups to focus in the outreach programme is the resident associations in principal urban areas namely Kuala Lumpur, Klang, Subang Jaya, Petaling Jaya and Shah Alam by virtue of their high population. Therefore, their relevance would be on the basis that there is direct correlation between the increase in population with increase in water use and demand.

Youth (15 to 40 years of age) constitute another critical group to target as it represents the largest age segment of the population. In particular, attention should be given to university students due to their high potential as change agents within their respective university, and working environment later on.

Having an informative and interactive website with quizzes and games would be particularly useful in reaching out to children and the youth.

Women, often the main water user at home, must also be given special attention in the WDM programme. One woman, for instance, noted that she was not in favour of front-loading washing machines because she could not open the door during the wash cycle to remove clothes that should not be subject to the full spin cycle. Ways have to be found to address concerns such as this.

Through training community group leaders can be empowered with knowledge and capacity on WDM so that they could function as catalysts in inculcating awareness and gaining support for WDM in their community.

Partnering the media

The media undeniably play a pivotal role as a communication platform in reaching out to the masses. They can help in raising and spreading awareness, creating interest, motivating change, and gaining support and commitment for WDM. It is important to establish the capacity of the media in communicating and reporting on WDM issues.

Therefore training should be provided through workshops to build up journalists' expertise in reporting on water issues including WDM and to engage the media as partners in outreach and communications campaigns.

Public campaigns

Public awareness campaigns generally consists of two distinct components namely knowledge and information transfer, and education. Normally their major goals are to mobilise support for on-going and future activities and ensure the sustainability of the programme¹¹.

Setting targets enables the evaluation of a campaign in meeting the desired outcomes. Equally important would be to ensure the targets are specific and realistic within the timeframe and planned interventions of the campaign. Some examples of campaign targets are shown in the table below.

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Butler, D & Memon, F A (2006)

Public campaigns may focus on the following:

- Promoting support for more stringent control and enforcement measures for prevention of water pollution and catchment degradation;
- raising awareness on methods to save water and use water more efficiently; and/or
- reducing water use by consumers.

Table 6: Examples of campaigns and their targets¹²

Country	Campaign	Target
Malaysia	National Water Saving Awareness Campaign (2006 – 2008)	10% reduction in domestic water use
Singapore	10-Litre Challenge (2006)	Reduce water use 10 litres daily by every individual
Singapore	10% Challenge for non-domestic sector (2008)	Reduce water demand 10% among non-domestic customers

Events and competitions

The public campaigns can be complemented by events and competitions to spark interest in demand management measures.

Events may include:

- Water Week with activities dedicated to help the public understand and take action to conserve water resources;
- Open day at waterworks.

Competitions may include:

- Annual awards programme recognizing achievements of business, institutions and individuals in using water efficiently;
- save water challenge to motivate consumers to assess and improve their water usage behaviour;
- essays, art and photography competitions on the water theme.

¹²

Partly based on Tay, T K (2008)

6 Conclusion

Water demand management (WMD) is an attractive measure, in its own right, as well as combined with development of water infrastructure, enhancement of domestic and non-domestic water efficiencies, and reduction of non-revenue water.

By implementing appropriate WMD and other water conservation measures, Selangor can be self-sufficient in water, even without inter-state transfers.

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**Center for River Basin Organizations and Management,
Solo, Central Java, Indonesia
www.crbom.org, info@crbom.org**