Policy Brief

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Understanding demand and funding for piped-water supply in Mandalay City

In brief:

- This study seeks to understand water usage patterns in Mandalay and to assess the possibility of and the extent to which current water tariffs can be increased or reconfigured.
- The researchers used a combination of in-depth interviews and a survey covering 1480 households and MSMEs across six townships in Mandalay.
- Additionally, this study analysed unique administrative data from the Mandalay City Development Committee to assess the impact of past tariff changes on consumption and revenue
- The findings suggest that due to the widespread access to sources of substitution for water in Mandalay, further increases of the tariff rate are expected to reduce piped-water consumption and have a limited impact on Mandalay's revenue.
- The authors recommend decreasing operational expenditure by assessing and reducing Non-Revenue Water, raising water revenue by increasing tariff levels for households up to 385 MMK per unit, and accounting for additional critical costs such as debt servicing.

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Background and motivation

Mandalay city is the second largest city of Myanmar with a population of 1.3 million. The city is managed by the Mandalay City Development Committee (MCDC), which has two departments that deal with water related issues. One is responsible for infrastructure installation, operations, and maintenance and a second, which falls under the Revenue Department, deals solely with water revenue. The latter department was established as water revenues represent one of the highest sources of revenue for the city. Water provision also accounts for some of the highest costs for the city.

Mandalay has approximately 90,000 water meters, of which 88,000 are residential and 2,000 are commercial. Some were installed 30 years ago and more are being rolled out now, particularly to low income townships. Strikingly, the MCDC is currently making a major loss in running its water system. MCDC estimates that they are not yet covering even 50% of operation and maintenance costs. This is without accounting for the need to expand and upgrade the system, much of which stems from colonial times.

MCDC has borrowed $104 million from International Financial Institutions (e.g., the Asia Development Bank and French Development Agency) to improve water service coverage and quality in Mandalay from 2017 to 2023. To pay off large capital expenditures and cover operational expenditures, the tariff was raised from 85 MMK ($0.06) in 2015 to 200 MMK ($0.15) per unit (one unit is 220 gallons). Therefore, this study aims to understand water use patterns, existing costs of the current water systems, the current structure of prices, and the impact of tariff changes in Mandalay. It also aims to examine a variety of mechanisms to help MCDC recover its operational expenditure through a mixture of revenue sources.

International experience

Generally, water tariffs, charges imposed on households or business for the private consumption of a service, come in one of three forms: a uniform and fixed charge, a graduated water-use charge based on a volumetric component, or a combination of fixed and use charges. Cities in India, such as Raipur, for example, use a fixed charge, which is based on the size of the water pipe, and other countries, such as Bolivia, use a block tariff scheme where users pay different amounts based on their overall consumption level. Many countries in Africa, such as Uganda and Namibia, adopt a two-part tariff structure, incorporating both a fixed charge and a water use charge. Mandalay uses uniform volumetric tariff but with fixed charge used for households with broken meters.

In addition, when considering costs, tariffs may solely recover economic costs of consumption and use, or they may also reflect environmental costs and equity goals. Water tariffs may also include treatment and sewage costs.

Therefore, a well-designed tariff structure ensures that consumers pay for what they consume. When designing these tariffs, governments may want to take into account aspects like affordability in order to ensure that low-income users are able to reach a minimum consumption level. This could be done through cross-subsidising tariffs where higher income groups help cover the cost for lower income consumers, or through subsidised household connections that ensure that poorer households can afford to connect to the network (as is the case in several African countries). However, any exceptions will necessarily complicate the design and therefore the ease of administering water tariffs and structures that are not well designed may result in revenue losses in the future. Therefore, the costs and benefits of tariff structures need to be considered carefully, depending on the context in which they are being implemented.

Methodology

To assess the options for reforming tariffs in Mandalay, data was collected through key informant interviews and a large survey involving 1480 respondents selected from all the six townships of Mandalay.

Key informant interviews were conducted with officials from MCDC and external relevant stakeholders. Respondents were asked to provide answers to questions about the water situation in Mandalay, past and ongoing initiatives, and existing issues pertaining to piped-water supply.

The quantitative survey aimed at understanding water use patterns and behavioural aspects such as perception, satisfaction, and expectations from piped-water supply in Mandalay. The sample was distributed proportionally to the actual population to ensure representation. The survey tool was developed into an application for mobile data collection, which allowed geo-tagging of respondents.

Water use patterns in Mandalay

In all townships, 75% to 85% of the population has access to two or more water sources. The most common sources of water are bottled water (71%) and tubewell (68%), followed by MCDC piped-water (35%). These figures do not differ between households and businesses.

There is an inverse relationship between MCDC piped-water and tubewells: those who have access to MCDC piped-water are almost 4 times less likely to have a tubewell.

Bottled water is the most preferred source of water for drinking (70%), but a sizeable proportion also uses tubewells (12%) and MCDC piped-water (17%). Water from tubewells and MCDC piped-water system are used for the same purposes, primarily for cooking, showering, and dishwashing, while water from ambient sources is preferred for cleaning and business purposes.

Income does not affect access to MCDC piped-water and tubewells, and plays a minor role in access to bottled water. On average, households spend around 40,000 MMK per year on MCDC piped-water.

Factors such as quality, accessibility, and reliability are considered more important than the cost of water. Most of the population is satisfied with all four aspects, although 32% reported being unsatisfied with the quality of water. Respectively 61% and 58% of the population consider that MCDC piped-water and tubewell water are not safe to drink. Greater proportions of MCDC users with access to alternative sources such as tubewells and bottled water tend to believe that MCDC water is not fit for drinking.

Existing costs of the current water systems

Recent studies estimate total expenditure on water and sanitation in 2014 to be approximately $3.7 million. This includes operating expenditure (OpEx) at $597,000 and capital investment (CapEx) at $3.1 million.

Reports from MCDC authorities in our study stated the current water supply system operates at a considerable loss approximately $2.4 million in 2016-2017. This implies that the central government is entirely responsible for funding Capex and largely subsidises OpEx.

A significant impact on OpEx is Non-revenue Water (NRW), which is the difference between the volume of water put into a water distribution system and the volume that is billed to customers. In

Mandalay, 52% of treated water is lost during transmission. Of this 70% can be attributed to physical loss (due to leakages or faulty pipes), while 30% is commercial loss (due to meter reading or data handling errors). Authorised unbilled usage, such as for monasteries or government buildings, is also NRW. This figure is uncertain for MCDC as they currently do not meter these entities.

In recent years, MCDC has invested heavily in its water and sanitation system, including treatment plants and expanding its piped network. MCDC reported 93,157 total meters across the six townships. Of these 55% function correctly, 14% are broken or approximately read and 31% currently are not using MCDC water.

Replacing meters costs about $100 for MCDC, and users are subsequently charged this amount for connecting to the water supply network. In recent months, MCDC began gradually shifting to usage of automatic-meter readers (AMRs), and users were not charged for the installation of upgraded meters.

Current structure of prices and impact of tariff changes

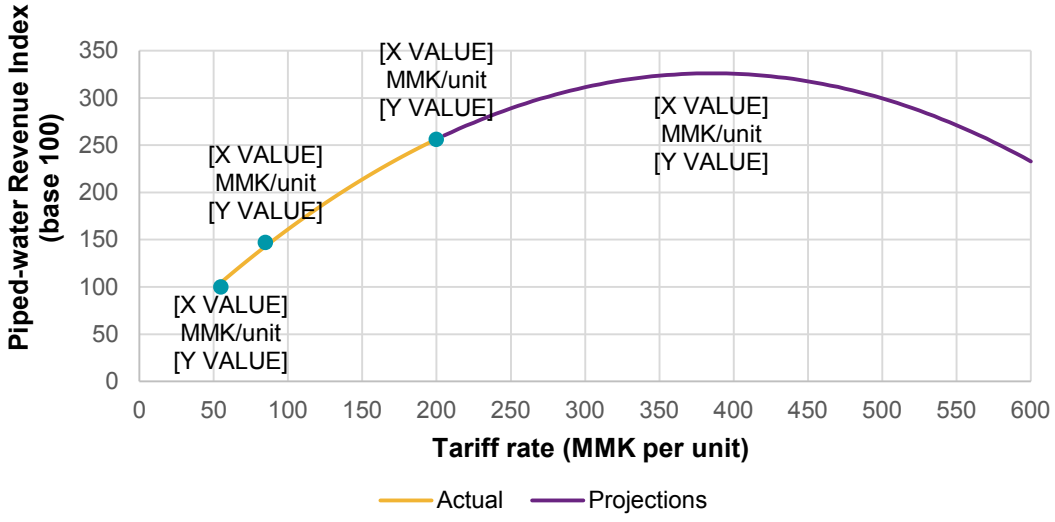
Using data obtained from MCDC Water Revenue Department, this section describes the reaction of consumers to water tariff changes and provides estimates on the expected response of demand to future tariff changes.

In 2015, the tariff increased from 55 MMK to 85 MMK, and in 2017 from 85 MMK to 200 MMK. Cumulatively, it is estimated that the two tariff changes led to an increase in revenue of 156%.

While water is generally considered a relatively inelastic good (i.e. demand does not react strongly to price variations), this is not the case in Mandalay due to widespread access to sources of substitution (e.g. tubewells). It is expected that further increases of the tariff will have a limited contribution to MCDC piped-water revenues due to decreasing marginal returns.

Increasing the tariff rate beyond 386 MMK/unit would affect piped-water consumption to such an extent that the marginal revenue generated would become negative. For instance, a tariff rate of 400 MMK/unit is expected to generate as much revenue as a tariff rate of 370 MMK/unit. This threshold is, however, expected to increase as Mandalay's income per capita grows, leading to higher potential to raise the tariff rate in the future.

Figure 1: Relationship between tariff rates and revenue



Policy implications and recommendations

In Mandalay, MCDC manages the operation and maintenance of public infrastructure. The majority of households in Mandalay do not receive water from MCDC and thus pay no tariffs. Most of those who are connected pay a flat fee, as the meters may not work accurately. Those who could be connected but prefer to continue using tubewells are levied a small use fee.

Currently, tariffs do not cover even the cost of limited water provision in Mandalay. One of the many reasons for this could be high levels of non-revenue water as explained in the previous section.

MCDC aims to progressively connect the entire population in six townships. People who connect will still use their existing source of water to some level. Two priorities emerge from MCDC's goals:

- Cover operation and maintenance costs of current system
- Maximise the usage of new connections by gradually reducing reliance on alternative sources

Reduce operational expenditure (OpEx)

Prioritise the assessment and reduction of NRW. Water lost to breakages, billing errors, and theft represents both environmental costs and economic inefficiency. Reducing NRW can increase cash flow for utilities, which may then expand the supply network without squandering water resources. A detailed assessment of NRW components, and the costs and benefits associated with reducing them would be the first step for MCDC.

The following are associated short to medium term recommendations:

- **Meter all unbilled authorised users, including monasteries and government offices, to get an accurate assessment of total production costs and subsidies.** Although charging these entities may not be politically or socially feasible, understanding the cost of supplying water to all users is important to budgeting accurately for maintenance and upgrades.
- **Meter all businesses and use graduated tariffs – especially those using large amounts of water.** As Mandalay grows and attracts more businesses it is critical that their use of all services be regulated. Unregulated tubewell drilling is likely to lead to groundwater depletion and future water access problems.
- **Promote accurate meter readings and data-handling.** This could be done by creating payment schedules for users unable to afford their regular bill and by rewarding reader teams for increases in accurate bills collected based on a benchmark.
- **Incentivise meter readers and users to report damaged meters, and technician teams to repair broken meters.** Meter readers have no incentives to report broken meters as they continue to charge families based on prior use. It is unclear whether MCDC or households are responsible for repairs and replacement.
- **Gradually switch to reliable automatic meter readers (AMRs).** AMRs are expensive and there is little capacity within MCDC to repair them. Additionally, there is a risk that households will switch to other sources if they perceive that they are paying more with AMRs. Thus, MCDC should prioritise large users (businesses) and areas where there is lower substitutability between piped and groundwater.
- **Install backflow prevention to prevent and minimise additional breakages and corrosion.**

Raising water revenue

Water tariffs are the second largest source of revenue for MCDC. As indicated by the research, tariff levels can only be raised to approximately 385 MMK per unit at current income levels.

Beyond this, a tariff increase will not yield an economically efficient return, but instead penalise the poorest consumers who rely on piped water.

Consider additional critical costs

Mandalay endeavours to improve WASH infrastructure and service provision through the construction of sewage treatment plants and expanding its piped water network. These initiatives will come with additional capital, operating, and debt servicing costs.

MCDC should include in its cost-benefit analysis the following costs:

- **Debt servicing and sustainability.** MCDC has multiple loans for the construction of new sewage treatment plants and the expansion of piped water network. All loans will need to be serviced, placing an additional burden on MCDC in coming years.
- **Climate change and water shortages.** Mandalay is located in the central dry zone of Myanmar and is already experiencing the effects of climate change with a longer dry season and lighter monsoon rains. Freshwater sources dry up in the long dry season and more businesses and households are turning to ground-water abstraction. If left unchecked, excessive use of groundwater will lead to its depletion and associated environmental issues.
- **Electricity comprises a significant portion of operating costs for MCDC s water provision.** By some accounts from MCDC officials, this reached approximately 40% of OpEx or approximately MMK 3.5 billion annually. Expanding the piped-water supply network and changing to AMR will add significantly to these costs. MCDC should accurately assess current electricity charges for its network and factor these into future cost-benefit analyses.