

A Study on Water Supply System of Sagaing City

Abstract

The urban development need to meet qualified water supply system. Research is necessary to solve operating system problem, to upgrade appropriate new technologies. In Sagaing city, the main water source is Ayeyarwady river water and financing sources for water services are funded by community itself and well wishers and assistances by JICA. There are 14 water committees, 2 are underground water projects and 12 are water pumping projects in city. There are not enough for the whole population with current water supply services. Water services consider for social sector and not favor for commercial units. Current systems some of which are old and in need of upgrading must expand services area, increase services frequency and improve efficiency to serve the demands.

Key words; Water, Water Supply, System, water Supply Committees

1. Introduction

1.1 Rationale of Study

The government that took office in March 2011 has introduced sweeping reforms, both to the political process and the economic system. Among the economic reforms, the new land law and foreign investment law address issues fundamental to development, as does unification of the former multiple exchange rate system. The government is in the process of finalizing its five year national development plan, 2012-2016, which consists of five sections;(i) Regions and States Development Plan;(ii) Villages, Townships ,and Districts Development Plan ;(iii) Industrial Development Plan;(iv) Investment Plan; and (v) Financial Sector Development Plan. The government has also prepared a framework for economic and social reform to guide implementation of the national development plan.

In response to the government's reforms and development plans, especially those concerning democratic representation, economics sanctions are now being lifted or suspended. This opens the possibility of extensive international assistance for Myanmar, including for its urban development and water sector. The urban development and urban water section are also an important section in regional and state development. An urban development program for Yangon is being prepared with technical and financial support from the Japan International Cooperation Agency (JICA).

Water services do not reach a large proportion of the urban population. Consumers have adapted to inadequate provision by improving self-supply, as demonstrated by the large number of small private systems, usually involving a tube well. In rural and peri-urban areas, rainwater catchment provide a partial solution to water needs. So, Water services should be systematically provided together with public and private society especially in urban areas.

1.2 National Water Policy in Myanmar

The goal is to apply Integrated Water Resources Management (IWRM) for sustainable development. The policy covers 2 broad areas such as (1) water resources management and (2) water resources use

1.2.1 Vision

Myanmar will become a water efficient nation based on Integrated Water Resources Management by the year 2020.

1.2.2 Mission

To implement water policy to all the agencies of water sector to further develop respective rules and regulations.

1.2.3 Objectives

- (a) To prepare national water policy
- (b) To establish water apex body
- (c) To invest in water sector and to manage water resources and priority river basin
- (d) To increase efficiency and accountability of services provider in water sector
- (e) To provide national policy on use of transboundary water courses
- (f) To invest in water education

1.2.4 Guiding Principles

- (a) To cooperate and coordinate between regional and union government for planning, development and management for water resources
- (b) Principle of equity and social justice should inform use and allocation of water
- (c) Good decision making is guided by good governance, transparency and accountability
- (d) Water needs to be managed as a common pool community resources
- (e) Environment water should be left for sustenance ecosystem
- (f) To consider river basin as a basic hydrological unit for planning purpose
- (g) Demand management should be given priority depending on the availability of water resources through maximum efficiency in use of water and water efficient of technologies
- (h) Water quality and quantity are interlinked and need to be managed in an integrated manner.

1.2.5 Strategies

Main strategies are;

- (a) Demand driven approach should be applied to develop and use of national water resources
- (b) To ensure proper land resources planning for extraction of groundwater
- (c) To ensure efficient means of domestic water supply
- (d) To protect all water resources including wetlands
- (e) Polluter-pay principles should be enforced
- (f) Problems in water supply (national level)

Myanmar water taking into account the 2012 study report of the Ministry of Health, Labor and Welfare, the O&M cost for the mobile water purifier were examined and the selling price of the drinking water was also estimated preliminarily and willingness of residents to pay for the drinking water was confirmed. Based on such studies, the business model that the new water supply board supplies the drinking water for a price while full-fledged water supply system is under construction was proposed furthermore instruction on formulating of the projects plan was conducted.

The contribution of municipal water supply to improving public hygiene is inadequate in cities. In other provincial cities, there is a noticeable lag and there are some cities where water supply does not exist. Not only is the provision of facilities delayed, but also the provision of various related systems and human resource development is delayed. Hence forth, overall development is necessary, such as coordination with the health sector, provision of systems, improved management of the Water Supply Board, and human resource development. For support to Myanmar in the provision of water supply systems aiming for steady and safe water supply, Japan had dispatched experts for the long term and the short term to the waterworks utility prior to 2004 for the development study of Yangon City and Mandalay City in 2000, before the movement toward democratization in Myanmar. Presently, the “Preparatory Study for Cooperation in the Water Supply Improvement Program (JICA Master Plan 2013),” which is the development study for provision of water supply to Yangon City and its surroundings, is being implemented. Grant aid cooperation (urgent rehabilitation plan for water supply facilities) and dispatch of advisors for supply of water for domestic use are underway, and these are anticipated to contribute to steady and safe water supply operations.

1.3 Objective of the Study

The main objective of this paper is to support as a part in the determination of water supply policy by applying the result and finding of a study on the current situations of Sagaing City water supply system.

1.4 Materials and Methods

- Using primary information from supervisors of water committee by using a structured questioners
- Key informant interview with officer of City Development Committee of Sagaing
- Using secondary data from report of City Development Committee of Sagaing about water supply
- Observing theoretical bases on the approach Development Economics

2. Historical Background of Sagaing city

Sagaing is a large region of the 7 regions in Myanmar and is the second largest constituent until of Myanmar after Shan State. Sagaing covers about 14 percent (93527km³) of Myanmar's area. It is divided into eight districts and 37 townships. Three townships (lahe,leshi and Nangun) from the Naga Self-Administered Zone. We express about Sagaing city into eight districts. Sagaing city is situated between Latitudes 20 50' N and 22 23'N and Longitudes 95 36' E and 96 63' E. Sagaing is bordered at the north by Wet let township, on the cost by Mattayatowship the opposite side of AyeyawaddyRiver and on the west by Myinmu township and Ayardaw township the opposite side of Mue river. The total area of the center of town is 7.44 square miles Sagaing city has many shadowy trees. As coveing Minwon mountain, Ayeyawady river flows in the east of Sagaing city.Because Sagaing city spreads Theravada buddhism, it is a peaceful and harmony city with shadow of buddha, dhamma and Sanagha.

Sagaing city belongs to traditional culture, historical settlements, buddha image, pogades and monestries. This attract to Sagaing city by many tourists. Moreover, tourists can study handicraft of sliverware, copperware, posts and hook farbric and others.

2.1.The population

Sagaing city has (19) quarters and the total population of Sagaing city is (62654) urban areas. The livelihood of local people of Sagaing city is most handicrafts based. Handicraft makes for year- round income and all members of social classes have private business, garden and other business. In so doing, the upper and middle classes, based on financial investment, industries or hotel, shop keeping or commerce. The lower class goes for craftsman, workers, jade cutting and drilling and so on.

2.2. Transportation

Bridges and roads built by the State which have smoothly take transportation not only Sagaing city but also other regions. In Sagaing city, there are railway lines and motor ways for transportation. Moreover, the State built Yatanapon bridge that it relate to Mandalay from

the city on the Ayeyawady river. The railway lines runs from Mandalay via Sagaing to Myintkyina. The motorways are Mandalay- Shwebo-Myintkyina and Mandalay-Sagaing-Monywa.

Sagaing city has located on railway line and motor ways from upper Myanmar to lower Myanmar. So, all products of Sagaing city has smoothly transported to upper Myanmar and lower Myanmar. The socio-economic of people in Sagaing city really improves because of their products has smoothly transported to upper Myanmar and lower Myanmar.

2.3. Weather and Environment Condition

Sagaing city locates between latitude 21°52' north and longitude 95°58' east. Sagaing city lies in the dry zone has an extremely hot climate. It gets annual rainfall ranging 34 inches. Sometimes it gets a small amount of rain in winter due to cyclones that enter coastal from the west.

Ayeyarwady river has been from its main economic arteries and have played a significant role for the region's history and culture. This river is played the main role for water resources of Sagaing city. This river runs ball-shaped in Sagaing city as covering Minwon mountain. Hundreds of shuephy peek out of the greenly of the hillside. The pagodes and monestaries crowed the numerous hills along the ride running parallel to the river. Sagaing city sees a honoured place with pagodes and monestries crowed hills and beautiful of Ayewarwady river. Agriculture and garden in Sagaing city is mainly provided by this river. The people, near Minwon mountain are difficult to use purified water because this is mountainous area. Tube well water with chemical can't drink by local people in this area. So, this river makes provision to use water for local people.

Ayeyarwady river runs ball-shaped that surrounding river needs clean in Sagaing city. The people live nearby in the river who will make maintenance for cleaning and beautiful of the river. Surrounding river makes clean so that the river stream is good in this area. In monsoon season, the river sometimes flooded because of more raining in upper area. Local people had made the ways for protecting flood and had constructed buildings around the river. Sometimes, the river flooded in Sagaing city that agriculture and garden caused damage. In winter and summer season, the river flows with the below average in amount of water. The local government and people have been taken maintenance to the river and natural environment.

3. Current Situation of Water Supply in Sagaing City

3.1. Activities of Sagaing Township Development Committee

Sagaing Township Development Committee is carrying out to develop the same commensurate of urban and rural in accordance with "the cities must be developed quickly".

In this action, the water supplying enterprises include as the main developed of cities. As an insurable committee in that cities, one duty of among the paint of many accountabilities is to supply fully purified drinking water of the city. To get fully purified drinking water, the citizens of Sagaing in any seasons and to get fully water 100 percent of encompassment, Sagaing Township Development Committee is to be submitting the plan of supplying water in Sagaing.

3.2. Ongoing the Situation of water supply and the percentage of encompassment of water

In Sagaing total population is 62654, if the population growth rate is 2 percent, populations will be 76276 in the next 10 years. If water per consumption is 20 gallons per day, the requirement of water will be 1525520 gallons every day.

Ongoing the situation supply of water is the following;

3.2.1 Shwe Min Winn Water supply committee

Shwe Min Winn Water supply committee was established in 2000-2001. The committee distributes to the ward which provided Honda Myanmar Co. Ltd. with gravities flow from hill tank reserve within the (120,000) gallons to (7000) inches distance Pawtawmu pagoda hill storage tank within (16,000) gallons by using 4"ø pipe line. There are (5520) populations in Shwe Min Win and requirement per day consumption are (110400) gallons. It can provide (8830) gallons (80%) per day. The rest of (20%) are provided by self-system with (63) tube wells.

3.2.2 MyaYadanar water supply committee

MyaYadanar water supply committee was established in June 2012. It distributes to the ward which provided Honda Myanmar Co. Ltd. with gravities flow from hill tank reserve within the (120,000) gallons to Sagaing Industry Zone (2) by 4"ø pipe line. There are (670) populations in Myayadanar and requirement per day consumption are (13400) gallons. It can provide (11000) gallons (82%) per day. The rest of (18%) are provided by (2) tube wells and a well.

3.2.3 PadaMyar water supply committee

PadaMyar water supply committee was established in 2011-2012. The committee distributes to the ward which provided Honda Myanmar Co. Ltd. with gravities flow from hill tank reserve within (120,000) gallons to along with the Shwe Min Win pipe line. There are (994) populations in Padamyar and requirement per day consumption are (19880) gallons. It can provide (15900) gallons (80%) per day. The rest of (20%) are provided by (27) tube wells and (7) wells.

3.2.4 Potan water supply committee

Potan water supply committee was established in 1993. The committee distributes to the ward by using direct pumping system through from the river side which absorbs with the motor pumping station in Htoparyong pagoda storage tank within (65000) gallons. There are (3606) population in Potan and requirement per day consumption are (72120) gallons. It can provide (74500) gallons (100%) per day. Potan water services also provided to Moe Zar Ward. There are (3095) populations in MorZar and requirement per day consumption are (61900) gallons. It can provide (43300) gallons (70%) per day. The rest of (30%) are provided by (30) tube wells and (10) wells.

3.2.5 Min Lan Wrad's Water Supply Committee

Min Lan Ward 's Water Supply Committee was established in 1985. This committee distributes the water by using Direct Pumping System to the ward in the water storage within (7800) gallons which absorbs by using the pump from the water pumping station at road of riverside from Ayeyarwaddy river. The 2384 of people lives in this ward and needs (47680) gallons per day. This water supply committee was supported (46750) gallons, (98) %. The (2) % of remaining is using by 15 wells of household self -water system so that it is sufficient for population.

3.2.6 Panbitan Ward's Water Supply Committee

Panbitan's Water Supply Committee was established in 1994. This committee distributes the water by using Direct Pumping System to the ward in the water storage at nearby Shwe Phone Pyint Pagoda within (10000) gallons which absorbs the water pumping station at road of riverside (strand road) from Ayeyarwaddy river. The 4241 of people

lives in this ward and needs (84820) gallons per day. This water supply committee supported (67850) gallons and (80) %.The (20)% of remaining is using by (30) tube wells and (80) wells so that it is sufficient the population.

3.2.7 Seingone Ward's Water Supply Committee

Seingone Ward's Water Committee was established in 1993. This committee distributes the water by using Direct Pumping System to the ward through the reserve tank which absorbs from water storage by Gravity Flow after the water storage within (20000) gallons at ShweToungOo Maw Pagoda is pushing the water pumping station with pump from Ayeyarwaddy river. The 4514 of people live in this ward and need (90280) gallons per day. The water distribution is (103625) gallons, (100) %.

3.2.8 MyotThit Ward's Water Supply Committee

MyotThit Ward's Water Supply Committee was established in 1985. This committee pushes to water storage with 2½" Ø 3HP Submersible Pump through water pumping from underground water and distributes by using Direct Pumping System from this water storage to their ward. The 3894 of people live in this ward and need (77880) gallons per day. This water supply committee supported (47900) gallons, (61) % per day. The (39) % of remaining is using by 215 wells of household self -water system so that it is sufficient for the population.

3.2.9 Takoung Ward's Water Supply committees

Takoung Ward's Water supply committee was established in 1992. This committee pushes to water storage within (40000) gallons from water pumping station nearby stand road at ThitsarSaeti Pagoda and distributes by using Gravity Flow System from this water storage to their ward. The 3399 of people live in this ward and need (67980) gallons per day. This water supply committee was distributed (54380) gallons, (80) % per day. The (20)% of remaining is using by 85 tubes and 8 wells of household self -water system so that it is sufficient for the population.

3.2.10 ZayarWard 's Water Supply Committee

ZayarWard's Water supply committee was established in 1994. This committee pushes to water storage within (30000) gallons through water pumping by using 4"Ø 180' with Mono Pump from underground water and distributes by using Gravity Flow System from this water storage to their ward. The 4393 of people live in this ward and need (87860) gallons per day. This water supply committee distributed (53000) gallons (60) % per day. The remaining (40)% is using by 85 tube wells and 8 wells of household self-water system with hand. This committee is preparing the new project of Ayeryarwady river with the aids of JICA.

3.2.11 Aye Myawady Ward's Water supply Committee

Aye Myawady Ward's Water supply committee was established in 1998. This committee pushes to the water tower within 25' high and 2400 gallons through water pumping by using 6"Ø 230' with Mono Pump from under ground water and distributes by using Gravity Flow System from this water storage to their ward. The 4039 of people live in this ward and need (80780) gallons per day. This water supply committee distributes (40400) gallons, (50) % per day. The remaining (50)% is the using directs from Ayeyarwaddy river , 10 wells and 50 of tube wells. It is sufficient for the populations.

3.2.12 Nilar Ward's Water Supply committee

Nilar ward's Water supply committee was established in June 2012. The committee distributes to the ward which provided Honda Myanmar Co. Ltd. with gravities flow from hill tank reserve within the (120,000) gallons through Sagaing Industrial Zone No. (2) Gravity flow with 4 inches PVP pipes. The (977) of people live in the ward and the requirement of water per day is (19540) gallons. It can distribute the (16600) gallons (85%) to wards per day. The remaining (15%) is from (5) tube wells and (3) wells.

3.2.13 Parami ward's Water supply Committee

Parami Water supply Committee was established in November, 2012. Totally estimated cost (Ks 1634) Lakh is financed from Japan (GGA) donation ks (979.58) Lakh and public contribution (654.42) Lakh. The committee distributes to the ward with push to Htonebo water storage within 19000 gollons with 25 hp 15 KW Motor pump and from tank reserver to Kyauktakhar Hill within 60000 gollons with 59 HP,40 KW 6 motor pump by connecting 6300' with 4" ø GI pipe. There are 1750 populations and the requirement of water per day is 35000 gallons. The situation of water supply per day is 60000 gallons.

3.3. Household self -water system

Wards of Dawayzay, Nandawon and Meeyiethar are absorbing household self-water system. There are (10970) of people live in the ward and the amount of water requirement per day is (219400) gallons.

3.4. The Situation of Operation and Financing within Five Year

Sagaing city has (19) wards and household self –water committee are serving for the city water supply system. The annual spending for expanding, repairing and maintaining water supply system are provisioned by the following.

Fiscal Year		
(a) 2013-2014	Budget year (Count)	219.3 Lakh
2013-2014	Budget year (Repair/ Maintained)	146.2 Lakh
(b) 2014-2015	Budget year (Count)	700 Lakh
2014-2015	Budget year (Maintained)	227.97 Lakh
(c) 2015-2016	Budget year (Count)	231.328 Lakh
2015-2016	Budget year (Repair/ Maintained)	154.2192 Lakh
(d) 2016-2017	Budget year (Count)	243.8247 Lakh
2016-2017	Budget year (Maintained)	162.5498 Lakh

(e) 2017-2018	Budget year (Count)	255.0713 Lakh
2017-2018	Budget year (Maintained)	170.047 Lakh

3.5. Enhancing Water Supply to fulfill 100 %

In Sagaing city, water supply system is normally running.

3.5.1 Five Year Plan

For the amount of water requirement in the wards are planning (100%) cover which is constructing, repairing and maintaining from water supply committee. From 2013-2014 Fiscal year to 2017-2018, City water supply system which is serving plan by described appendix table (3-5).

3.5.2 New Project of water supply system with JICA: Expansion for water supply project

In recently, Honda Myanmar Co. is providing to Sagaing Industry zone and 4 wards – Shwe Min Won, Myayanar, Padamyar and Nilar. There are not enough for all because of increasing firms and households in Sagaing. Therefore, Sagaing City Development Committee are executing jointly with JICA. The estimating cost and plan of this new project are expressed with Appendix (3-6).

After this project, Honda Myanmar Co. Ltd. will provide only to Industrial Zone. And those, JICA new project will provide to Shwe Min Won, Myayanar, Padamyar and Nilar and also including Zaryar ward. Therefore, JICA water supply project can provide to (5) wards in Sagaing now. This new project can provide more safely for households because of water treatment system.

4. Analyzing of Water Supply System

4.1 Water Supply Committee

In this section, we studied a variety of types of water supply system in Sagaing City. There are 19 Wards in Sagaing City. But all Wards have not been serviced by water supply system. The 14 Wards are using water supply system and the rest Wards are using water by self-system. This survey is found that the water supply systems of most buildings make integrated use of 3 types of systems, namely direct supply system, indirect supply system and sump and pump supply system.

Table 4.1 Water Supply Committee

No. of BOD members	Committee	%
3	1	7
5	4	29
6	3	21
9	1	7
10	2	14
13	1	7
14	1	7
19	1	7
	14	100

Source: Survey Data (10-1-2016)

Above table shows the condition of water supply committee made up by members. It can be found that one of committee made up by members (19 members) and most of committee (28.6%) include five members.

4.2 Water Supply System

There are two main sources of water for distributed to public by water supply committees such as Ayeyarwady River and underground water. Among 14 water supply committees in Sagaing, the major source of 10 water supply committees (71%) are Ayeyarwady River and 4 water supply committees (29%) are underground water. Therefore the Ayeyarwady River is essential for water supply in Sagaing City.

Table 4.2 water supply sources

Sr.No.	Water Supply Sources	Committee	%
1	Water Pumping Project	10	71
2	Underground Water Project	4	29
		14	100

Source: Survey Data (10-1-2016)

The water supply systems of committees are using 3 types of water supply such as direct supply system, indirect supply system and pump supply system. Water supply system

of 10 committees are using indirect supply system and far from wards. Water supply system of 4 committees are using direct supply system and pump supply system and nearby wards.

Table 4.3 Situation of Water Services Committee

Particular	Served	Not Served	Total
Total Population	44471(71%)	18183(29%)	62654(100%)
Requirement Water Per day	889425(71%)	363655(29%)	1253080(100%)
Estimated Water Consumption Per day	20 gallons		

Source: Survey Data (10-1-2016)

Above table calculated the typical family uses about 20 gallons of water per day in Sagaing city. So, requirement water per day for Sagaing City is (1253080) gallons. However water supply committees are served (889425) gallons and are not served (363655) gallons. In addition, 71% of total population had served by water committee and 29% of total population had not served by water committee.

Table 4.4 Collecting System

Sr. No.	Charge Rate Per Unit	Committee	%
1	100	1	10
2	130	1	10
3	150	2	20
4	180	1	10
5	350	3	30
6	450	2	20
		10	100
Remark: There are 4 Committee Estimated Collecting System.			

Source: Survey Data (10-1-2016)

Water supply committees are various types of collecting charge rate per unit. But there will not accurate because 4 water supply committees are collected by estimating charge rate for use of water and the rest committees are collected by various charge rate per unit with meter. There are 2 committees charged by 450 kyats per unit, 3 committees charged by 350 kyats per unit, 2 committees charged by 150 kyats per unit and the rest committees charged by 180 kyats, 130 kyats and 100 kyats respectively per unit for use of water.

Table 4.5 Situation of Other Unit Served by water supply committee

Particular	Food Center	Livestock	Donation Units	Offices
Have Not	11(79%)	13(93%)	2(14%)	5(36%)
Have	3(21%)	1(7%)	12(86%)	9(64%)

Source: Survey Data (10-1-2016)

There are only 3 (21%) water committees is providing to commercial units(food center) and only one committee (7%) is providing to commercial unit (livestock). The remaining 11 committees, (79%) cannot provide food center and 13 committees (93%) cannot provide to livestock. The water supply committees do not achieve the economics benefit and they are favoring the social sector (benefit). If the committees can expand water services, there will be the mutual benefits among services providers, households and for community as a whole.

Sagaing City has (14) Wards which have distribution of water supply. Distribution of water supply committees of (12) Wards which has been donated the water supply to schools, seminary and schools of welfare. Distribution of water supply of two wards has taken charges for its distribution. The 86% of water supply committees donate water to people within this Ward in Sagaing city. The 14% of water supply committees deliver by charges. Delivery is free of charge by water supply committees of (9) Wards to the government office. Delivery is charge by water supply committees of (5) Wards. Delivery of water supply is free of charge to the government office that it has 64% of the city. And those, delivery of water supply are fee of charges to the government office that it has 36 % of the city.

Distribution of water supply committees should deliver free of charge with part time system to schools, seminary and schools of welfare. Moreover, this committee should be taken distribution of water supply to the government office by taking fee at full time. In the above table, the two water committees should undertake water supply to donation units.

Table 4.6 Management of Operation System

Particular	Risk in Operation	Specialists	Treatment	Fire Protection
Have Not	12(86%)	13(93%)	14(100%)	7(50%)
Have	2(14%)	1(7%)	-	7(50%)

Source: Survey Data (10-1-2016)

When we studied the fourteen water supply committees, There are (12) water supply committees whose had pumping system from Ayeyarwady River in Sagaing City and (2) water supply committees which had pumping system from tube well in Sagaing City. At all of this, twelve committees had been taken for getting purified drinking water by digging tube well 50 meters away from farms of animal husbandry , waste baskets , toilets and chemical pesticides using cultivated land. In the two of water distribution committees, tube wells dig at starting that it has weak points according to the situation of the tube well area.

According to comparing all of committees, 86% of this delivers purified water as long with naturally system. And 14% of distribution committees have weak points for getting purified water.

Now a day is the age of improving technology. So, water involves not only pollution with chemical but also clean environment. It is suggested that they have been brought purified system for getting clean drinking and supply water to local people within Sagaing city.

Therefore, skill persons are needed for purifying of using purified system, never waste of water distribution system, management of their income and expenditures and others. Professional engineers and staff also needs for them. According to the study, skill persons has been organized 7% of all committees but 93% of all committees did not organize skill persons. So, the size of business depends on skill persons who assign in this business at the part time or full time.

Water purified system has not used in their distribution when we studied distribution of water supply committees. Therefore, (14) wards of committees deliver water supply that it does not provide a guaranty of health but it only uses by cheap price. If this committees use purified system, local people will also be sufficient for using and drinking purified water. And those, their income can increase by taking a little increase of price of purified water because of using purified system. Local people can be used purified water as well as cheap price that it has cheap price and suitability for health. Moreover, local people do not have healthy cost for curative diseases that it uses not purified water.

Water is very important for fire-fighting especially in dry zone. In Sagaing City, there are 7 committees (50%) for fire-fighting purposes among 14 committees and cannot 7 committees (50%).

5. Conclusion

5.1 Finding and Suggestions

Sagaing is located on the bank of Ayeyarwady River. Thus sources of water in Sagaing heavily depend on Ayeyarwady River. The water demands in city have increased along with population increase and urbanization. 71% of water committees are water pumping projects from river so the environmental preservation is becoming more and more a government and population priority. For the reason a project like this requires special attention due to the possible environmental changes not only in the Sagaing region but in the entire country.

This paper can be seen that the quantity of water is not enough for all population. It is also not effective use of water resources. The water supply strategy is specific important and relevance for economics and social sector. If it can water services extend, there will be economic of scale due to so many commercial units in Sagaing.

In systems where consumption is not metered, so cannot be measured accurately; best guesses can be attempted in city. Although most of committee collects by per unit, some committee is collecting by per month (estimated). Collecting system needs to upgrade with committee and user agreement. Water charges rate should be determined on volumetric basis. Existing pricing policy needs to be reviewed together with the use of community. Accounting for the various uses of water is more difficult in particular, few municipalities meter the water used for fire fighting, public standpipes, and parks.

Water treatment plant is not to be constructed in water committees. The filtering system should be applied for quality of raw water in every committee.

It is also required to reform the water sector by decentralization to promote the role of services providers and local communities and adopting demand responsive approach for funding. Regulatory framework is necessary for introducing the management contract is more suitable to encourage private sector to enter into the water supply operation in country.

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