"Project Formulation Survey" under the Governmental Commission on the Projects for ODA Overseas Economic Cooperation in FY2013

Summary Report

India

The Survey of an Applicability of Small-Scale Water Treatment Unit to Water Supply System Expansion

March 2014

The Joint Venture between
Koyo Engineering Co., Ltd. and Pacific Consultants Co., Ltd.

The content of this report is a summary of the project formulation survey, which was commissioned by the Ministry of Foreign Affairs of Japan in the FY 2013 and is carried out by the Joint Venture between Koyo Engineering Co., Ltd. and Pacific Consultants Co., Ltd.. It does not represent the official view of the Ministry of Foreign Affairs.

Introduction

Background

The overriding issue in water supply sector in India is development of water supply system to meet the sudden surge in water demand caused by increases of urban population and urban activities. According to the estimates by UNICEF in 2010, access rates to safe drinking water at national level is 97% in urban area and 90% in rural area, however, the access rate of piped water is 48%, which is almost the same as 20 years ago.

In response to this issue, the Government of India has stated the necessity for a promotion of infrastructure development in the Twelfth Five Year Plan (2012-2017) and the National Water Policy, and the Ministry of Urban Development has been implementing 2 programs, JNNURM for major cities and UIDSSMT for small and medium cities. However, water supply infrastructure particularly in small and medium cities is less developed, as it requires large investment cost. Low-budget water utilities tend to be affected by temporary measures such as reducing water supply hours, thus neither scheduled strengthening of water supply system nor expansion of service area have been managed.

The State of Maharashtra, the target city of this survey Badlapur is located, has a higher population increase rate in urban peripheral and local cities among the other states in the country. Badlapur city experiences thriving condominium apartment building developments, which are built by private developers prior to the development of the water supply mains. Meanwhile, development of urban water supply system takes several years, after the submission of development application till the completion of construction work. For this reason, as a mean for fast-track increasing in water supply capacity, a water treatment unit that is compact and easy to facilitate is required since it could be easily relocated from where water supply mains are implemented to the other area.

Purpose

The purpose of this survey is to explore the feasibility of a project that can contribute to the increase in the level of water supply services in India, by verifying the adaptability of Japanese SME's product, a sand filtration unit called "Reach Filter", through its demonstration using Official Development Assistance (ODA) projects that apply SME's technology and its transfer to the counterpart agency.

Survey Team

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I. Description of the current situation and development needs of the concerned development issues in India

The overriding issue in water supply sector in India is development of water supply system to meet the sudden surge in water demand due to a rapid population growth in urban area. The Government of India has promoted infrastructure development by setting a vision for an achievement of 24X7 water supply in urban area where currently experiences intermittent water supply. The State of Maharashtra set the achievement of 24X7 as a political mission, prior to the other states in India.

Badlapur, the survey target city, experiences rapid increase in population caused by private housing development. Many of those housing emerged in the area where public water supply network was not yet implemented. Most of those housings provide water to the resident by pumping the water from the ground in their site, until they receive public water supply services.

As a management organization for public water supply in both cities of Badlapur and its adjacent Ambernath in a united system, Maharashtra Jeevan Pradhikaran Water Management Division Ambernath (hereinafter referred to as MJP Ambernath) has been addressing this issue, however, current operation rates of 3 existing water treatment plants (hereinafter referred to as WTPs) exceed their designed capacities as shown below.

Table 1. The Designed Capacity and Current Load of Existing 3 WTPs

Name	Planned Treatment Capacity (m^3/day)	Actual Treatment Volume (m^3/day)	Load Factor
Barrage WTP	50,000	63,000	126%
Kharvai WTP	18,000	26,000	144%
Chikhloli WTP	6,000	8,000	133%

Therefore, a prompt increase in water supply capacity has been a major challenge to be dealt with for the MJP Ambernath. In 2010, the MJP Ambernath made the capacity strengthening plan targeting the year of 2018 to increase by 21 MLD (Million Litters per Day) water treatment capacities, and the plan has just started to be implemented after receiving the approval in 2013. It normally takes several years from the applications for the permission of construction from the state government till the completion of work, and during the course, housing developments keep growing with higher speed than estimated earlier. According to the own research by the MJP Ambernath, approximately 20 MLD of water demand has emerged by the construction of condominium apartment buildings in the east part of Badlapur alone, considering the current water leakage of 30%.

In order to meet such a growing water demand until the implementation of public water supply mains, the MJP Ambernath intends to install a compact and easy to use water treatment unit as a temporal and a prompt countermeasure, and such a unit is expected to be relocated from where water supply mains are implemented to the other area.

II. Possible applicability of the SME's products and technologies, and prospects for future business development

II.1 Features of the SME’s products and technologies

Sand filtration, though being a traditional and still a main water treatment technology in the world, has been facing a major challenge of perfect cleaning of the sand. When the sand is not completely washed, solidification in the sand layer, the so called ‘mad ball’ is gradually formed,

which causes functional deterioration of filtration, which requires frequent change of the sand.

The Reach Filter, holding a patent in Japan and 6 European countries such as United Kingdom of Great Britain and Northern Ireland, French Republic, Federal Republic of Germany, etc. is a low cost and easy to operate and maintain sand filtration unit that overcomes this challenge. It has also the advantage of low running cost. The Reach Filter reduces running cost for electricity and changing filter by approximately 80% compared to conventional pressure sand filtration unit.

Figure 1. RFE-2500s installed in Japan

II.2 Prospects for future business development

The SME prospects to develop the future business by applying the unit to the public water supply system and the private condominium apartment buildings, through the establishment of local company having functions of local production of the Reach Filter by procuring general parts of the Reach Filter and assembling, as well as promoting business in those markets.

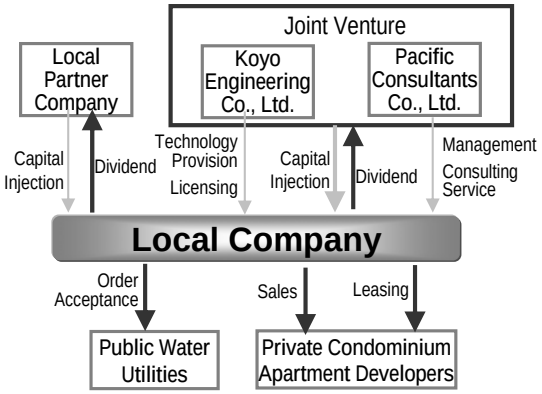

Figure 2. Expecting Future Formation of Business Management

However, it normally takes time to prepare an establishment of a local company, and to transfer the technology of welding, assembling and O&M to local employees. Considering the cumbersome business customs in India such as taxations, tendering procedures, the risk of delay of payment and so on, it is reasonable for Japanese SME to establish a business framework by stages of gaining business know-how and building a partnership with local companies before entering directly to the Indian market. In this sense, it is realistic to export the product from Japan and leave the sales to a local partner who has the license and access to the MJP tender process as a first step, and to shift the manufacturing base to the local gradually.

As for the amount of business in the public water utilities, it is estimated to be 407.02 MLD water demand that may reach up to 2016 in both 'A' class Municipal Councils and 'B' class Municipal Councils in the State of Maharashtra, where MJP manages their water supply system. Supposing the maximum capacity of the Reach Filter, RFE-2500 (2 MLD/Unit) covers 10% of this demand, it is expected that 20 units will be ordered in the public water supply sector.

A brief estimation of interannual cost compared with RFE-2500 and conventional rapid sand filtration plant made by MJP indicates that the accumulated expenditure considering the initial and the O&M costs of conventional plant exceeds that of RFE-2500 after 4 years.

The basis of calculation are as follows;

- The initial cost of the RFE-2500 includes procurement cost, profit of SME, expenses for an export including custom clearance, taxes, charges of local agent and ancillary facilities such as coagulation tank for highly turbid

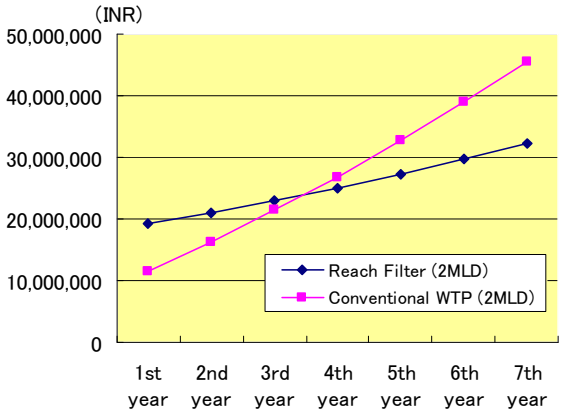

Figure 3. Interannual Cost Comparison with RFE-2500 and Conventional WTP

water pretreatment.

- The O&M cost of the RFE-2500 is composed of chemical cost for pretreating raw water from the mainstream in the area that records higher turbidity in the rainy season, electricity cost of 24 hours running pumping used for both backwashing and discharging, labour cost assuming one manpower for daily checking, and maintenance cost for refilling filter sand.

- For the conventional rapid sand filtration plant made by MJP, the initial cost is referred to the "Schedule of Rate 2012-2013" published by MJP, and the O&M costs are based on the data provided by the MJP Ambernath, converting to the same treatment volume of RFE-2500.

III. Verification of adaptability of the SME's products and technologies to India (Demonstration and pilot survey)

III.1 Demonstration Purpose

Considering the aim of application of the Reach Filter at providing alternative solution for water treatment capacity increase, the SME conducted the demonstration and pilot survey for the following purposes:

- To verify the superior water treatment capability of the Reach Filter to the conventional rapid sand filtration WTP

- To estimate the annual O&M cost of the Reach Filter for the cost comparison with the conventional rapid sand filtration WTP

III.2 Arrangement for Demonstration

A demonstration unit with a maximum capacity of 0.2 MLD was placed in the Chikhloli WTP site, using existing pump well facility to take raw water which is a leakage of the Chikhloli Dam at the upper stream.

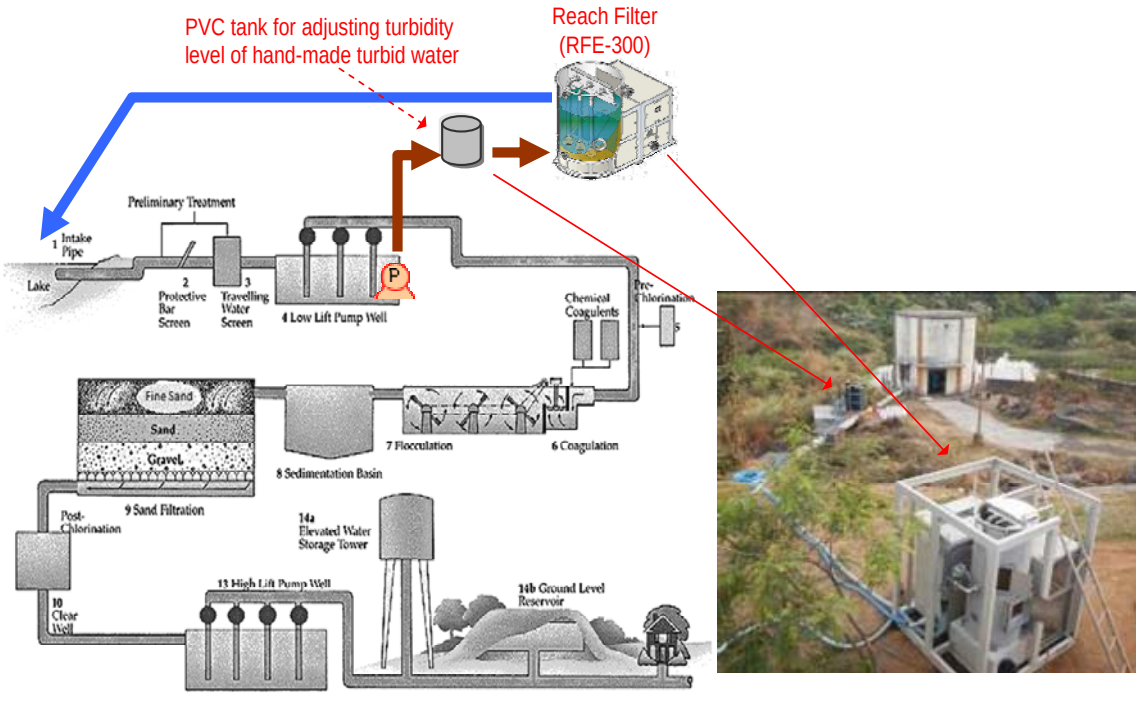

Figure 4. Schematic Diagram of Facilities for the Verification

The demonstration took place during the dry season in India, when the turbidity of natural raw water is low and stable. In order to test the treatment ability for highly turbid raw water, silt was mixed in the PVC tank to control the inflow water turbidity for the test purpose.

Three kinds of sand were used as filter media for the purpose of checking differences among their treating abilities. Imported Japanese sand were the same as used for the Reach Filters in operation in Japan, and two kinds of Indian sand were procured in India, one is the sand with relatively coarse and uneven grain sizes that is actually used in WTP, and the other is fine sand with specifications similar to the Japanese Sand.

Table 2. Differences of Filter Medias Used for Demonstration

	Japanese sand	Indian coarse sand	Indian fine sand
Diameter	0.6mm	0.65～0.75mm	0.6mm
Uniformity Coefficient	1.4	Unknown	1.5
Picture			

III.3 Result

The result led irrelevance of Indian coarse sand, since turbidity of treated water exceeded the Indian standard of 1.0 NTU sometimes and its filtration duration was shorter for the case of highly turbid water due to the occurrence of breakthrough phenomenon of water in the sand layer.

The performance of Indian fine sand was relatively higher than that of Japanese sand, as shown in the figures below.

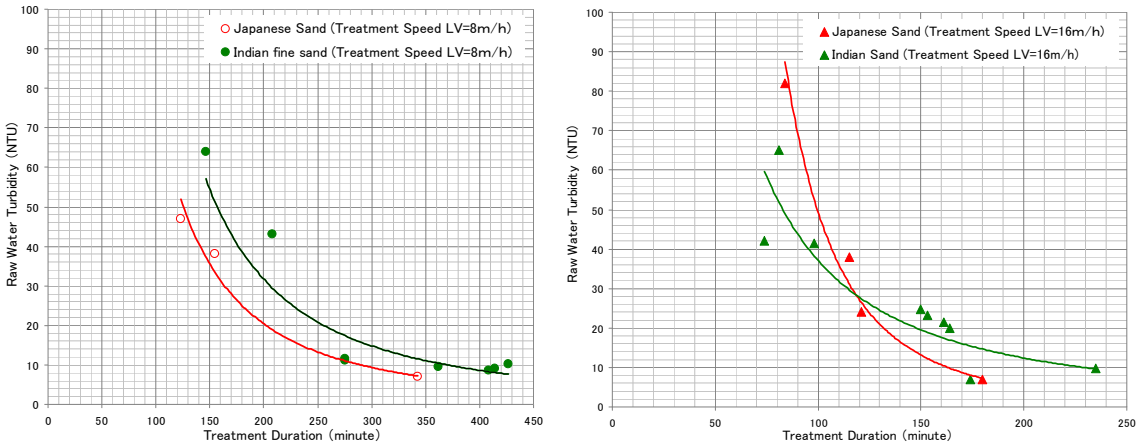

Figure 5. Comparison of Treatment Performance With Indian and Japanese Sands

In the case of higher turbidity with high treatment speed (LV=16m/h), treatment duration of both Indian and Japanese sands are relatively short. Therefore, it was found that an equipment of water storage tank in which the aggregation agent PAC is mixed to reduce the raw water turbidity prior to flowing in the Reach Filter is desirable.

The estimated annual O&M cost for RFE-2500 is 1,704,126 INR, using the result of demonstration and the past three years daily record of raw water turbidity of the mainstream of the area, Ulhas River.

IV. Expected development impact and effect on business development of the proposing SME in India through proposed ODA projects

The direct development impact of the introduction of Reach Filter to India is the increase in the access rates to safe drinking water. In addition, the following side effects should be taken into account:

- Securing of sufficient amount of water contributes to the achievement of 24X7 water supply;
- In the case of low water pressure in the mains that often occur in intermittent water supply, it may cause a reverse permeation of underground water. A continuous water supply with sufficient water amount that keeps the steady water pressure in the mains contributes to the safe water supply in the area where groundwater is contaminated;
- Reach Filter is more flexible in installation location compared with conventional water treatment plant which location is limited to the site close to the main river or dam. Introduction of Reach Filter in urban fringe area free from groundwater contamination or polluted domestic and commercial surface water contributes to the efficient use of unharnessed water resources.

In order to disseminate the Reach Filter as a temporal but prompt solution for the issue of water treatment deficiency particularly in small and medium cities in India, a full scale verification of advantages of the Reach Filter is necessary. This can be brought by implementing Japanese ODA project in the following phase, in which actual data of performance in various conditions throughout a year and manageability in O&M will be presented to Indian side. It is also expected to have an impact on raising the awareness of above mentioned side effects.

On the other hand, an implementation of ODA project is a valid and feasible way for the SME that has been facing sales drop in the Japanese water supply production market. In order to explore and promote business overseas, promotion activity of its product and reputations is essential. For SME in general, however, there is human resources and financing constraint for those activities. ODA project is expected to play a role in creating a great deal of business promotion in India.

V. Proposals for formulating ODA projects

V.1 Models of ODA Project Proposal

Considering the needs of the MJP Ambernath, the following 2 models of ODA project proposals are reviewed.

1) Increase in water treatment capacity of Chikhloli WTP

Needs Amounts	Features
【Urgent Needs: 2MLD】 RFE-2500: 1 Unit 【Future Needs in total: 6MLD】 RFE-2500: 3 Units	- Diversion of water supply from the existing mains for villages between the Chikhloli WTP and Navare Nagar ESR - Additional installations of RFE are expected after the ODA project to match the increase in needs and water resources - Utilizing the existing water resources from Chikhloli Dam and existing distribution networks of Chikhloli WTP

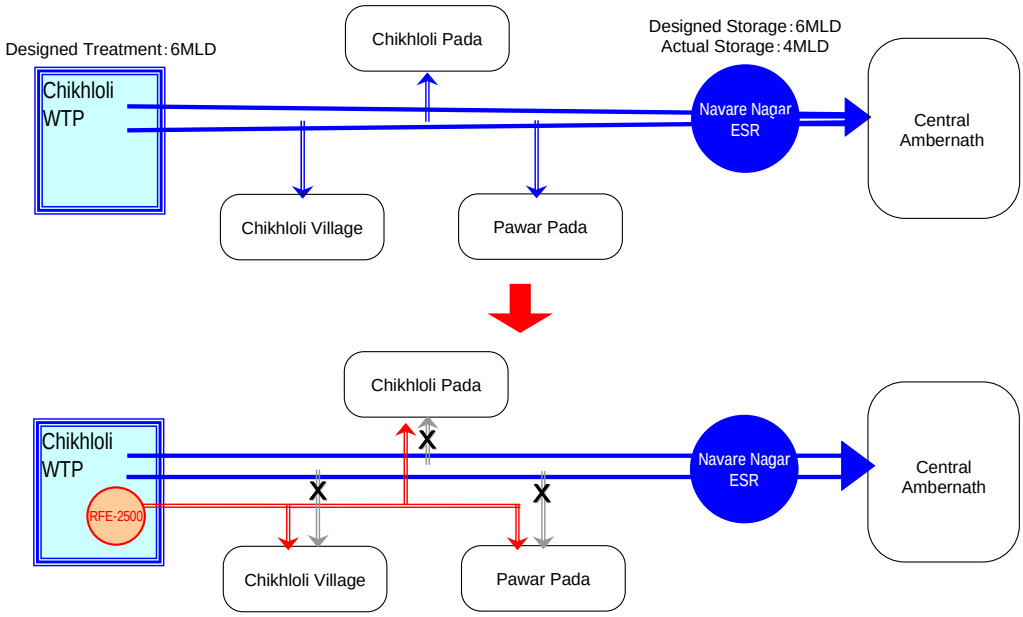

Figure 6. Features and Image of ODA model in Chikhloli WTP

2) Operating load mitigation for Kharvai WTP

Needs Amounts	Features
【Urgent Needs: 4MLD】 RFE-2500: 2 Unit 【Future Needs in total: 6MLD】 RFE-2500: 3 Units	- Additional and direct distribution for the condominium apartment buildings under construction in the lower land of Kharvai WTP - Utilizing the existing water intake under onstruction at the WTP next to Kharvai WTP

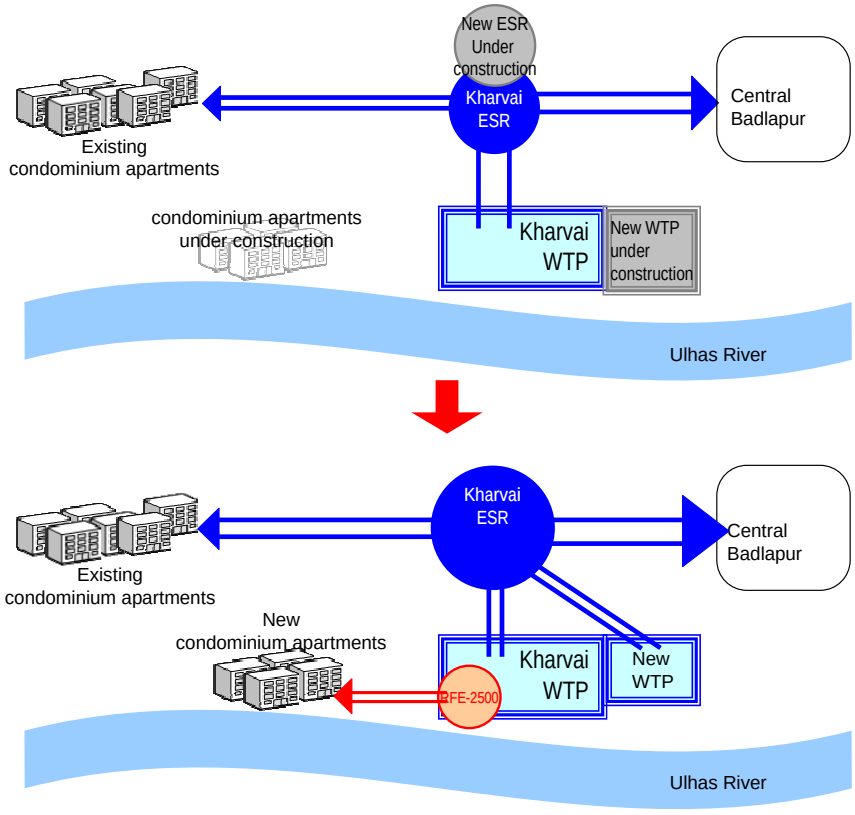

Figure 7. Features and Image of ODA model in Kharvai WTP

V.2 Outline of ODA Project Implementation

[Project Purpose]

The purposes of those 3 ODA project models are set as follows;

- Realization of development impacts after a prompt increase in access rate to safe drinking water and a contribution to the achievement of 24X7 water supply
- Verification of stability of the actual and full-size Reach Filter throughout the year
- Technology transfer to the staffs in the MJP Ambernath for an O&M of the Reach Filter

[Schedule]

Project implementation schedule includes an operation term of over a year, considering one of the project purposes which is to verify the stability of the Reach Filter for higher and fluctuated raw water turbidity in the rainy season from June to October

[Inputs]

Expected project inputs from Japan side are the grant of 2 units of the Reach Filter, dispatch of experts, manuals for O&M, and emergency response. Those from Indian side are provision of land, equipments and electricity for the verification, arrangement for an actual use of the Reach Filter such as water intake and distribution including earth work, and allocation of counterpart staffs.

Project Formulation Survey
India, Applicability of Small-Scale Water Treatment Unit to Water Supply System Expansion

SMEs and Counterpart Organization

- Name of SME: Joint Venture between Koyo Engineering Co., Ltd. and Pacific Consultants Co., Ltd.
- Location of SME: Shinagawa Ward, Tokyo / Tama City, Tokyo
- Survey Site ・Counterpart Organization: Badlapur Municipal Corporation, Maharashtra ・MJP Water Management Div., Ambernath

Concerned Development Issues

- Increase in the public water supply amount to meet the sudden surge in water demand
- Many of condominium apartment buildings, which are built prior to the development of the water supply mains, install their own wells to serve untreated water to the residents
- It normally takes several years for public water system from planning to the completion of construction, therefore the supply amount become insufficient for the increasing demand, hence it is difficult to achieve 24X7 water supply scheme that the central and state governments pursue

Products and Technologies of SMEs

- Small scale sand filtration unit 'Reach Filter', overcoming the perfect cleaning requirement of sand, which has long been a major obstacle for sand filtration technology
- Low running cost compared to the other filtration devices
- Sand filtration is a technology easy to operate, maintain
- Compact scale allows fast-track installation



Proposed ODA Projects and Expected Impact Based on the Survey

- According to the requirement from C/P organization, install 2 units of Reach Filter close to the bustling housing development area as a temporary but prompt solution for water treatment deficiency (resulting in an increase of 25,947 population which gains access to safe and stable as 24X7 water supply)
- Contribute to a continuous increase in access rate to safe drinking water by relocating the Reach Filter to another area with higher demand, even when an additional conventional water treatment plant is developed

Future Business Development of SMEs

- Taking advantages of gaining track-record and raising awareness through ODA project implementation, explore the business market of both public water utilities and private housing developers
- Building partnership with local company who has a license and an access to the public tender process, establish a local manufacturing and management company in the future