Capacity Building Program for Non-Revenue Water Reduction Techniques in India

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Abstract—*Water is precious! The access to safe water in India has commendably improved from 72% in 1990 to 94% in 2014. Delay in providing facilities to counterbalance the population growth and water demand is the major problem in India. Water loss in water distribution systems in an important issue in India. Studies indicate that up to 50-60 percent of treated and pumped water in lost during transit form water treatment plant to consumer end. It has, therefore, attracted a lot of attention of practioners and the researchers as well over the past few years. High levels of non-revenue water (NRW) reflect huge volumes of water lost through physical and apparent loss components, not being invoiced to customers. It seriously affects the financial viability of water utilities through lost revenue and increased costs. The overall objective of a distribution system is to deliver wholesome water to consumers at adequate residual pressure in sufficient quantity and achieve continuity and maximum coverage by reducing losses. A case study of 4-pilot sites of Jaipur city was taken for NRW study. This paper provides a review of the issues and strategy pertaining to reduction of NRW with special reference to India and the necessity of evolving appropriate performance indicator.*

Keywords— Non Revenue water (NRW), Real Losses, Leak Detection, and Water Balance Chart.

I. INTRODUCTION

Statistics reveal that near about 45 million cubic meters of water are lost every day through water leakage in the distribution networks in developing countries. One of the major issues resulting to this vast quantity is the considerable difference between the amount of water put into the distribution system and the amount of water billed to consumers i.e. the Non-Revenue Water (NRW). Though it may not seem feasible to totally eradicate NRW in a water utility, however reducing by half the current level of losses in developing countries does appear to be a realistic target.

Few of the reasons for such negligence could be cited as lack of governance, autonomy, accountability and technical and managerial skills necessary to provide reliable service. Capacity Building and Training Programme enables people, communities and systems to strengthen their capabilities to plan, develop and implement services in efforts to prevent or respond to disasters, conflicts and other humanitarian emergencies.

In developing countries like India, water utilities often operate under a weak governance and financial framework. They have to provide some form of service to customers on a daily basis with mostly deteriorated infrastructure. In addition, they often lack the proper incentives—as well as the specialist management and technical expertise—necessary to carry out an effective NRW program. This is where big shot authorities such as World Bank, Asian Development Bank and JICA come in to play to provide technical assistance for capacity building. They provide delegated management contracts such as public-private partnerships [PPP], leases or management contracts, service contracts, limited subcontracting of specific activities etc.

II. NRW- DEFINITION

Non revenue water (NRW) is water that has been produced and is "lost" before it reaches the customer. It comprises of three basic components:

- Physical losses comprise leakage from all parts of the system and overflows at the utility's storage tanks. They are caused by poor operations and maintenance, the lack of active leakage control, and poor quality of underground assets.
- Commercial losses are caused by customer meter under registration, data-handling errors, and theft of water in various forms.
- Unbilled authorized consumption includes water used by the utility for operational purposes, water used for firefighting, and water provided for free to certain consumer groups.

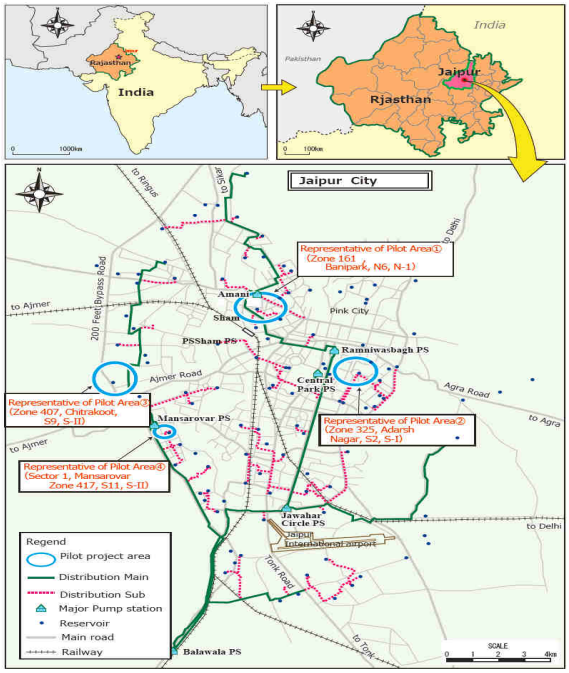
The Background

The apparent water losses result from illegal connections, under registration of customers' meters, inaccurate meters, stopped meters, vandalized meters, bypassed meters, billing errors, inadequate meter reading policy, bribery and corruption of meter readers. High level of real loss reduces the amount of precious water reaching customers,

increases the operating costs of the utility and making capital investments in new resource schemes. The major issues affecting water utilities in India is the considerable difference between the amount of System Input Volume (SIV) into the distribution system and the amount of water billed to consumers called "Non Revenue Water".

Introduction to Jaipur's initiative

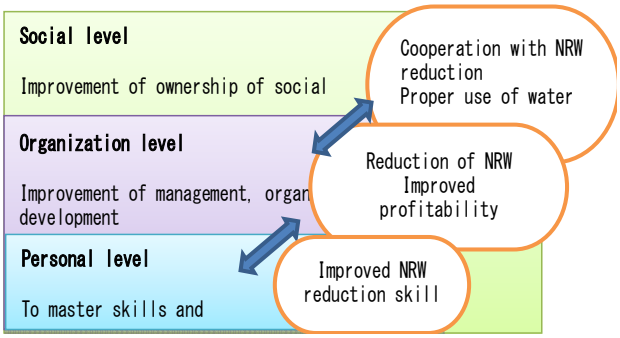
In Jaipur India, where population is about 3 million, water transmission and supply facilities from the Bisalpur Dam located 120 km from the southwestern side of the city is constructed through the Bisalpur Jaipur Water Supply Project. Water supply from the dam started in March 2009, and water from the dam, together with groundwater, is now being supplied to the inhabitants. Although groundwater reliance of Jaipur has improved from 97% to about 25%, the quality of water supply services is still relatively low because water resources are limited compared to the increasing demand and water supply is about 2 hours a day because of shortage of water supply originated by a high NRW rate (around 30%).



PHED Rajasthan which is in charge of the water supply business in Jaipur has been addressing the improvement of water supply service through the rehabilitation of distribution pipes, pumps and meters, including the establishment of a GIS system and the customer center as a part of its capacity improvement plan. It considers that it is essential for its staff to improve their capacity for the dissemination of NRW countermeasures. Stepping ahead, PHED requested the Japanese Government to provide technical assistance for a project called "Capacity Development Project for Non-Revenue Water (NRW) Reduction in Jaipur City."

III. CAPACITY DEVELOPMENT PLAN

The programme aims at improvement of the water supply services. PHED Rajasthan has been facing problem in content to profitability. As a measure it tries to obtain the users understanding of proper use of water and fair share of the burden under the operation policy of state government for sound management..



Social level Capacity Development is achieved through public relation (PR) activities by raising awareness. PR urges public to realize the improvement of water supply services. This project announces the positive outputs of the pilot areas actively. Residents in the pilot project area will also be examined, and comments will be compared before and after the pilot project for evaluation of water supply service, willingness to pay, expectancy of service improvement, etc.

Policies of Capacity Development Plan –

3.1. Personal (Management Level) –

The target of Capacity program is Preparing NRW reduction plan, Monitoring and analysis of NRW countermeasures, Preparing Execution plan including investment plan by conducting training to improve understanding of NRW reduction (Seminar, training, etc.), Verification of water balance calculation method, Assistance to planning and implementation of NRW reduction and Recommendation based on the cost/benefit and financial analysis.

3.2. Personal (General employee level) –

It includes assistance to establishing Training Unit, Conducting TOT while preparing training module and material and Assistance to making internal training plan and implementation, Establishment of trainer certification system, Conducting training for NRW reduction technique based on personal capacity assessment and need analysis (lecture, OJT, etc.) and Support on operation of work as OJT.

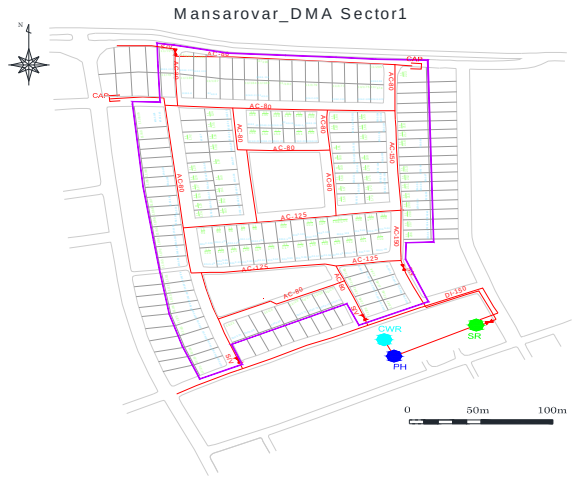
3.3. Organization level – It includes Building and sharing awareness of issues through training and Steering Committee, Recommendation to spreading output to whole city based on the lessons learnt, Improvement for services for 24 Hours water supply, Project management for 24 hours continuous supply, Support Making policy to dispel sense of injustice e.g., optimization of meter reading Strengthening Public relation.

3.4. Society (Related Contractor & User level) – It includes improvement of construction management capacity of PHED staff (training), Evaluation of possibility of training for private contractors in future, Support to have campaign for realization of 24 hours supply. Assistance to conduct public relation about the project and water works as well.

IV. A CASE OF- MANSAROVAR SEC- I

Location	Sector 1 SII, S11
Area	0.11 km2
Number of households	140
Number of meters	137
Initial meter condition	63 meters were not-functional
Supply hours	24 hours

24 Hours water supply started from Nov-2010 soon after the implementation of the project by Eco-Asia and Ranhill Malasiya. In addition, the pilot area was isolated too. At the start of the Capacity Development project, 45.3% of domestic water meters were in un-functional condition. Leakage repair works was conducted by out-sourcing. All the surface leakages were mostly found by resident & PHED. However, groundwater leakage survey was not conducted completely.



Before starting with the leakage survey, work-shops regarding basic information of NRW were held for PHED staff (EE, AE, JE, Meter readers, Meter Inspectors, Helpers, and Pump Operators) as a part of Capacity Development. Next, training was conducted with the procured equipments for both PHED and out-sourcing staff.

4.1. Baseline Survey –

PHED and JET surveyed all the 140 residents through interview in order to obtain current condition of water meter, water consumption condition, condition of isolation, consumer's satisfaction level and so on. The electromagnetic flow-meter which was installed at inflow point was repaired after comparison with portable ultrasonic flow-meter as the master flow-meter. In August 2014, supplied water amount was measured with repaired electromagnetic flow-meter to measure baseline. NRW baseline was then calculated with average billed consumption of the last six months. The figure was 52.8%.

1st Benchmarking	
Measurement date	from 13 Aug 2014 to 20 Aug
Billed Metered Consumption	115.22 m3/day
Supply water amount	244.17 m3/day
Minimum Night flow survey	5.7 – 6.2m3/hour
Calculated NRW Ratio	52.8 %

After the replacement of 133 water meters (Rest 4 no occupants) again measured NRW ratio.

2nd Benchmarking	
Measurement date	from 04 Sep 2014 to 30 Sep
Billed Metered Consumption	157.73 m3/day
Supply water amount	230.41 m3/day
Minimum Night flow survey	4.3m3/hour
Calculated water loss ratio	31.5 %

4.2. Leakage Survey –

After the second benchmarking, countermeasures were conducted. OJT training for leakage survey was implemented with PHED and out-sourcing staff with active participation of JET using leak detection equipment. Groundwater leakage detection survey was performed during midnight when night flow is minimum.

Such leakages were mainly found in the service connections.

Countermeasures		
Conducting date from November 2014 to30 JUNE 2015		
	Patrol	Twice a week
	Surface leakage repair	40 Place
	Underground leakage repair	3 Place
	Replacement of domestic water meter	Number 133 (100%)(rest houses are no occupants)
	Replacement or repair of service connection	10 check valves were replaced
	Disconnection of illegal connection	2 Place
Others		
IEC	Distribute handout and visit customer's house for awareness raising towards water saving.	

Activities taken to countermeasure NRW –

- Preparation & release of IEC material and Publicity of project through newspaper.
- Identification of leaking service pipelines.
- Installation of pressure loggers for monitoring regular pressure.

V. CONCLUSION

Despite of obvious potential that such engagement of government officials could be viewed as a new magic formula for solving the many woes of public water utilities in developing countries like India. It can been seen as a way of bringing some rapid improvements in terms of increased cash flows and more water availability to serve the population, by efficiently using the prospective of big funding companies.

Keeping the Mansarovar initiative in focus it can be concluded that by demonstrating a successful performance-based service, a positive dynamic for change can be created in the field of NRW reduction within the utility and can be expanded to a wider range as a whole so that they can more effectively serve the need of the growing population in countries like India.

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