Helpline for Water Leakages: A Solution to Water Crisis

Jethoo A.S.[1] & GuptaN.K.[2]
[1]*Malviya National Institute of Technology, Jaipur, India*
jethoo@rediffmail.com
[2]*Water Resource Department, Government of Rajasthan, Jaipur, India*

KEYWORDS
NRW, Leakage, Helpline, Water Conservation

ABSTRACT:
Every year, more than 32 billion cubic meters of treated water physically leak from urban water supply systems around the world, while 16 billion cubic meters are delivered to customers for zero revenue. Half of these losses are in developing countries, where public utilities are starving for additional revenues to finance expansion of services and where most connected customers suffer from intermittent supply and poor water quality. India is on the developing country where these losses due to water leakages are a big problem in the path of efficient water management. In this paper we have suggested a model of helpline for water leakages to reduce NRW. A sample survey has been conducted which reflected the willingness of adopting the proposed model.

1. INTRODUCTION

A water system includes intakes, water pipelines, storage reservoirs and pumps. Once the water enters the system at the intakes from the source, pumps provide energy to convey the water through the pipelines to storage reservoirs from which it is distributed to consumers. Pipelines are formed of multiple pipes with joints and leakage generally occurs where the pipe joints are faulty or where defects develop in the pipe body. As longer the leaks remain unattended larger the economic and resource loss will be to the authorities, as electric power to run the pumps and chemicals to treat water are also wasted. Pressure in mains, water hammers, soil instability, corrosion of water pipes, poor quality of fittings, traffic loading, age of components are some of the main factors responsible leakages.

A current study by the World Bank estimates the value of global non-revenue water at $18 billion a year, with $5 billion of this in developed countries. Non-revenue water (NRW) is water that has been produced and is “lost” before it reaches the legitimate customer. Losses can be real losses (through leaks, sometimes also referred to as physical losses) or apparent losses (for example through theft or metering inaccuracies). High levels of NRW are detrimental to the financial viability of water utilities, as well to the quality of the water itself. NRW is typically measured as the volume of water "lost" as a share of net water produced. Leak detection technology can be effectively applied in typical European pipelines, and that the leakage rates in these pipelines do indeed make it an economical practice (Donnelly et al. 2009). However, it is sometimes also expressed as the volume of water “lost” per km of water distribution network per day. Many problems are created due to increased amount of Non-Revenue Water. Conservation measures to manage customer demand coupled with accurately accounting for and managing water losses as water is transported from raw sources through treatment, transmission and distribution systems (Pickard et al. 2007).

According to a statement issued by the central government, several studies about these water losses, commonly called non-revenue water (NRW) indicate that it varies from 30 to 50%. The results of the pilot study in 28 cities of India indicate the average NRW as 39%. An assessment shows 20 to 50 per cent water losses from leakages in major Indian cities and Bangalore accounts for one of the highest in all major Indian cities. One of the main reasons is due to leakages which accumulate up to 50 per cent of water wastage.

If we can minimize the wastage of water by managing the timely repair of the leakage points, we can save a huge quantity of treated water which will save the precious water as well as reduce the

expenditure. Fresh water, as fossil fuels, is scarce and must be utilized efficiently. Many methods for controlling leakage from urban water supply systems have emerged, but it still remains a challenge in developing countries like India. In many cities of India, this type of demand to reduce NRW through leakages has arisen like in Pune. Thus to tackle the problem of water leakage we need efficient Plumbing services, which is being proposed through this work. Leakage detection technologies reduce Non-Revenue Water (Audrey and Xing 2011).

2. URBAN WATER CRISES IN INDIA

There is a large gap between water availability and demand. As this gap increases, a water supply management system has to face the crisis. This water crisis is more problematic in urban areas due to higher population density & per capita consumption.

2.1. Scenario

Even though the rate of urbanization in India is among the lowest in the world, the nation has more than 350 million city-dwellers. Experts predict that this number will rise even further, and by 2020, about 40 per cent of India's population will be living in cities. This is going to put further pressure on the already strained centralized water supply systems of urban areas.

The urban water supply and sanitation sector in the country is suffering from inadequate levels of service, an increasing demand-supply gap, poor sanitary conditions and deteriorating financial and technical performance. According to Central Public Health Engineering Organization (CPHEO) estimates, as on 31 March 2000, 88 per cent of urban population has access to a potable water supply but this supply is highly erratic and unreliable. Transmission and distribution networks are old and poorly maintained, and generally of poor quality. Consequential physical losses are typically high, ranging from 25 to over 50 per cent. Low pressures and intermittent supplies allow back siphoning, which results in contamination of water in the distribution network. Water is typically available for only 2-8 hours a day in most Indian cities. The situation is even worse in summer when water is available only for a few minutes, sometimes not at all.

2.2. What a stress?

According to a World Bank study, of the 27 Asian cities with populations over 1,000,000 Chennai and Delhi rank as the worst performing metropolitan cities in terms of hours of water availability per day, while Mumbai is ranked as second worst performer and Calcutta fourth worst (Nair, K.S.2007). In most cities, centralized water supply systems depend on surface water sources like dams, rivers and lakes. Chennai, for instance, has to bring in water from a distance of 200 km whereas Bangalore gets its water from the Cauvery river, which is 95 km away. Where surface water sources fail to meet the rising demand, groundwater reserves are being tapped, often to unsustainable levels.

Most of the cities are facing potable water crisis. Even The nation's capital Delhi is perpetually in the grip of a water crisis, more so during the dry season, when the situation gets particularly worse. As the demand-supply gap widens, more groundwater is being exploited. The same water crisis situation is prevailing in Channai, Banglore and Jaipur. Due to shortage of supply against demand, tube wells were constructed in areas that were found unfeasible by the Ground Water Department (GWD). This was due to lack of coordination between the PHED and the GWD. The only solution seems to be efficient in utilization of available water resources.

3. SOLUTIONS TO URBAN WATER CRISIS

Urban water crisis is to be dealt with to ensure the survival of future generations and mankind. In this regard we have to reduce NRW anyhow.

3.1. Non-Revenue Water (NRW)

Non-revenue water is the difference between the volume of water put into a water distribution system and the volume that is billed to customers. NRW comprises three components: physical (or real) losses, commercial (or apparent) losses, and unbilled authorized consumption. Loss of water due to leakage is a common phenomenon observed in all water distribution systems (WDS). The volume of leakage around the world is considerably high and its control is crucial to meet the increasing water demand caused by rapid population growth and urbanization. The most important component of a leakage control strategy is target setting in terms of economic level of leakage (ELL). The ELL is an economic indicator depending on individual network conditions, operating system pressures, demands and their patterns, the marginal cost of water, and operating practices (Islam and Babel 2012).

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 user for firefighting, and water provided free to certain consumer groups.

3.2. Solution: Resource saving is Resource Generation

Leakage is a problem that draws worldwide attention. In the United States and the United Kingdom leakage ranges from 10 to 30 %. In developing countries leakage may reach even 70 %. In an international perspective, leakage in the Netherlands is low: approximately 3 to 7 % of distribution input. This low leakage draws international attention. Recently, a research project has been completed where the experiences of British and Dutch water companies have been exchanged (Beuken et al. 2006).

Water supply is massive consumers of energy, which is consumed in each of the stages of water production and supply chain. Energy is lost due to reasons: Insufficient pump stations poor design, old pipes with high head loss, excessive supply pressure etc. Another major cause for energy waste is an excessive supply due to water leaks or due to insufficient water use. When the worldwide water loss average is estimated to be 30%, it means that the very same portion of energy is lost. Given the above causes, energy consumption savings might get to 20% - 30% of the current consumption. Thus we need an institution which is dedicated to saving the leakage for economic and energy gain. The energy to pump water is a significant element of operational costs (Giustolisi et al. 2012). Therefore it is the need of the time to consider the philosophy i.e. "Resource Saving is Resource Generation".

4. PROPOSED MODEL

We are proposing a model by which we can ensure a timely repair of the leakages whether in the distribution system or in the dwelling houses.

4.1. Helpline for Water Leakage: Reduced NRW

One of the ways to reduce the NRW is to control the water leakage problems. Thus to tackle the problems of water leakage we need efficient Plumbing services, which is being proposed through this study. The plumbing industry is a basic and substantial part of every developed economy due to the need for clean water, and proper collection and transport of water & wastes.

In this study, we are proposing a model of helpline for water leakages as named "CALL US @555", which is a customer care plumbing door to door service provider, similar to various other call on services like well-known services of police, fire helpline & ambulance etc. This service will facilitate the common mass to experience the cheap, modern and faster way to their water leaking problems. The service will not only cover the household leaking problem but it will also look into the leaking problems at public place in association with existing government institutions. In this study, survey was done with more than 300 people through online form portal and door to door survey. Survey results shows that 88% of the sample population remark

the proposed concept as excellent or very good and 82% are willing to use the service. If this service starts then 88% population is willing to pay accordingly.

4.2. Survey Work Conducted for the Proposed Model

A survey was done with more than 300 people through the online form portal and door to door survey. The survey includes demographic survey, the problems encountered by the public during water leakage, their reaction, and response towards saving water from leakage and also to this service. Demographic survey was conducted in various categories like sex, Age, Family size, Monthly income.

Overall survey was completed with 90 female and 210 male. Under demographic survey, the survey was also done on the basis of age. Main participation came from youth. 49 % contribution came from the age group of 18-25 while 32 % contribution came from age group of 25-40.

Various other parameters related to the subject of water crisis were also asked. We organized the collected data in various scales viz. nominal scale, ordinal scale, interval scale etc. The responses of the persons interviewed are converted in percentage and shown in table 1.

Table 1. Response of Sample survey on various parameters

S.N.	Parameter	Scale/ Survey Result (%)			
1	How many houses include a private garden?	Yes	No		
		52	48		
2	What is the major source of household water supply?	Govt. Supply	Own source	Shared taps	Both 1&2
		62	14	6	18
3	How many public supply connections exist in a household?	Families having water connection	Families having one connection	Families having two connections	Families having >2 connections
		78	71	18	11
4	People monthly paying for their water consumption?	0-50	50-100	100-200	>200
		18	26	34	22
5	How many people have leaking taps or overflows in their house?	Yes	No	I don't know	
		33	56	11	
6	How often people check their faucets/ fixtures for leaks?	Monthly	Bimonthly	Annually	Never
		33	24	26	17
7	How many face leakage problems in water tank?	Yes	No		
		72	28		
8	How people respond to the water leakage problem at home?	Don't have time	Think for a while	Ignore	Call to plumber
		6	35	7	52
9	Where do people find water leaking problem at home?	Joints	Taps	Ignore	Others
		25	60	11	4

S.N.	Parameter	Scale/ Survey Result (%)			
10	How people respond when they see any leakage at some public place?	Ignore	Complaint to Govt. Officials	Self effort	
		36	28	36	
11	How people respond when they see any leakage at their friend's house?	Ignore	Suggest to repair	Self effort	
		45	42	13	
12	How people remark this concept?	Excellent	Very Good	Good	Poor
		58	30	10	2
13	If this service starts then will they prefer to use the service?	Yes	No	Can't	
		82	7	11	
14	If this service starts then will they call after seeing a leakage at public place?	Yes	No	Can't	
		78	7	15	
15	Will they pay for the service?	Yes	No		
		88	12		
16	What is the average cost plumber charge for a visit?	0-100	100-200	200-400	>400
		12	36	42	10
17	How much people are ready to pay?	0-100	100-200	200-400	>400
		18	46	32	4

Above survey results shows that 88% of the sample population remark the proposed concept as excellent/ very good and 82% are willing to use the service. If this service starts then 88% population is willing to pay accordingly.

4.3. How The Proposed Help Line System Will Work?

Customer care call center wing is meant to register the complaints of the common mass. This wing will then further intimate this complaint to the complaint office in the estate department. The office of Estate Department will work as the caretaker of this service, and will be responsible for the execution of work. It will look after the quality and workmanship. It will also monitor the demand and supply of the equipment. The system will have a store where all the equipment required and materials will be stored. Once the technician is ready with all the formalities a customer service agent will contact the customer and will intimate the schedule of service. The technician will then-Inspect all visible portions of the customer's plumbing system. He's experienced and trained to solve the problem on the spot. Check operation of valves. Make necessary adjustments to the customer's system, but only upon customer's approval, and only at the guaranteed price. Instruct homeowner of proper procedures in case of emergency.

5. RESULTS AND CONCLUSIONS

The main cause of water scarcity is the leakage, a part of Non-Revenue Water (NRW). Due to heavy leakage, treated water go waste without utilization even it also lead to water borne diseases. If we

treat the leakage within the time we can save invaluable water along with ample amount and resources which has been invested in storage and distribution of that water. Looking to this aspect it is proposed in this paper to adopt a system of a toll free center @ 555 to repair the domestic as well as distribution leakage within prescribed time and charges. Doing this we will be able to save 8 billion cubic meters per year of already treated water—enough water to service an additional 90 million people who currently lack access to piped water and to save an estimated US$1. 6 billion per year in production and pumping costs for public utilities. Sample survey shows that people do not have ample time, knowledge and awareness about the invaluable loss through these types of leakages. They are willing to use and pay for the proposed service. This type of Helpline will become a solution to the problem of water crisis.

REFERENCES

Andrew Donnelly; Anthony Bond; and Kevin Laven (2009) "Application of Advanced Leak Detection Technologies in Portugal" ISBN (print): 978-0-7844-1069-1.Publisher: American Society of Civil Engineers.

Badami A., Shahani A., Shah F., (2012), "A Smart device to identify Leakages in water pipeline" International Journal of Scientific & Engineering Research, Volume 3, Issue 5, May-2012 1 ISSN 2229-5518 IJSER © 2012 http://www.ijser.org

Baosong Ma,Mohammad Najafi, Guosheng Jiang, and Larry Slavin (2011), "Internal Free Swimming Pipeline Leakage Detection Technology—Smartball" International Conference on Pipelines and Trenchless Technology 2011, Beijing, China ISBN (print): 978-0-7844-1202-2Publisher: American Society of Civil Engineers.

Brian Pickard; Jeff Vilagos; Glenn Nestel (2007); Daniel Lanning4; Stephen Kuhr5; and RudyFernandez6; "Reducing Non-Revenue Water — It's Good Business: [A Case Study Featuring Tampa Water Department's Non-Revenue Water Reduction Strategy Utilizing the Latest AWWA Water Audit Methods and Tools]" ASCE, World Environmental and Water Resources Congress 2007 , 10.1061/40927(243)532

Giustolisi, O., Laucelli, D., and Berardi, L (2012). "Operational Optimization: Water Losses vs. Energy Costs." J. Hydraul. Eng. doi: 10.1061/ (ASCE) HY.1943-7900.0000681.

Islam, M. and Babel, M. (2012). "Economic Analysis of Leakage in the Bangkok Water Distribution System" Journal of Water Resources Planning and Management, ISSN (print): 0733-9496ISSN (online): 1943-5452Publisher: American Society of Civil Engineers

Nair, K.S., "Socio-Economic and Environmental Issues Associated With Urban Water Management in India." International Symposium on New Directions in Urban Water Management - 12-14 September 2007, UNESCO Paris

Steven G. Buchberger;Robert M Clark; Walter M. Grayman; and James G. Uber(2006)"Low Leakage in the Netherlands" Eighth Annual Water Distribution Systems Analysis Symposium (WDSA)ISBN (print): 978-0-7844-0941-1Publisher: American Society of Civil Engineers.