



Water Audit

- Amol Chiplunkar

Background

Water is a precious natural national resource with almost fixed quantum of availability. With continuous growth in country's population, per capita availability of utilizable water is going down, whereas with ever-rising standard of living of people, all around rapid industrialization and urbanization, demand of fresh water is going up continuously. Unabated discharge of industrial effluents into water bodies is further aggravating the situation of scarcity of water of acceptable quality. In spite of the fact that fresh water is rapidly becoming scarce it is continued to be used wastefully.

The guesstimate indicates the vast potential of water savings which can be effectively used in alleviating the pressing water scarcity as also in meeting our increasing water demands. All that is needed is long-term committed movement in the direction of optimization of the operating efficiency of the systems for irrigation, domestic and industrial sector. For the purpose Water Conservation is taken as one of the eight national

The National Action Plan on Climate Change

was formally launched on June 30th, 2008. The NAPCC identifies measures that promote development objectives while also yielding co-benefits for addressing climate change effectively. The eight missions are

- National Solar Mission
- National Mission for Enhanced Energy Efficiency
- National Mission on Sustainable Habitat
- **National Water Mission**
- National Mission for Sustaining the Himalayan Ecosystem
- National Mission for a Green India
- National Mission for Sustainable Agriculture
- National Mission on Strategic Knowledge for Climate Change

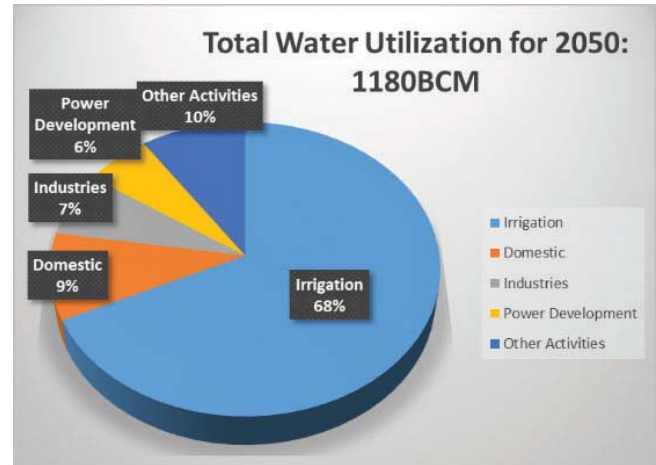
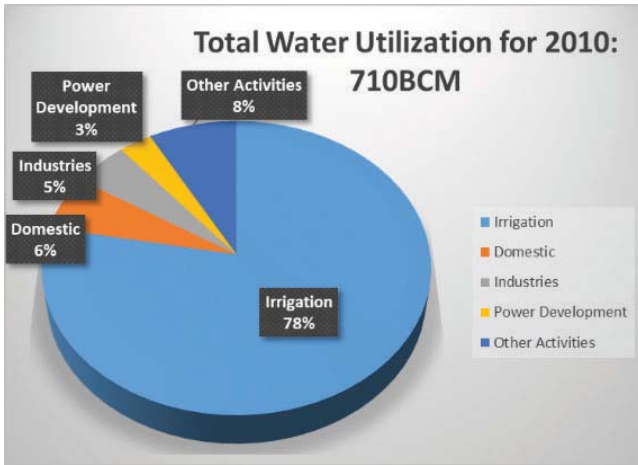
missions taken up for mitigation of climate change under the National Action Plan on Climate Change (NAPCC). The mission is named as National Water Mission.

The National Water Mission – Mission document

As mentioned above, for the long term movement, National Water Mission was drafted by MoWR, RD&GR through wider consultative process. The main objective of the National Water Mission is "conservation of water, minimizing wastage and ensuring its more equitable distribution both across and within States through integrated water resources development and management". Out of its five goals, one is to improve the efficiency of water use by 20%. For achieving this, various strategies have been identified as under:

- Research in area of increasing water use efficiency and maintaining its quality in agriculture, industry and domestic sector
- Incentivize recycling of water including wastewater
- Development of eco-friendly sanitation system
- Improve efficiency of urban water supply system
- Efficiency labelling of water appliances and fixtures
- Promotion of water efficient techniques and technologies
- Undertake Pilot projects for improvement in water use efficiency in collaboration with States
- Promote Water Regulatory Authorities for ensuring equitable water distribution and rational charges for water facilities
- Promote mandatory water audit including those for drinking water purposes
- Adequate provision for operation & maintenance of water resources projects
- Incentive through award for water conservation & efficient use of water
- Incentivize use of efficient irrigation practices and fully utilize the created facilities.

The National Commission for Integrated Water Resources Development (NCIWRD) estimates total withdrawal/utilization for the year 2010 and the year 2050 as shown in the charts below.



Achieving high water use efficiency is thus the first step along the path towards sustainable water development and management. The National Water Policy, 2012 also lays stress on conservation of water. One way to ensure rapid sustainable development is to attempt highest standards of efficiency in water use besides demand side optimal management through mass awareness.

Irrigation Sector: As of now irrigation sector consumes about 80% of the total water use which may reduce to about 70% by 2050 due to competing demands from other sectors. Most of the irrigation projects are very old and have become less efficient. Before optimization matters are suggested, time has come when water audit has to be implemented in material terms and water resources projects are to be audited on annual basis. It is a very significant exercise for; it gives fair idea of total water drawn from the source, its actual use and the water lost in the system. Some of the water loss in any system is inevitable but any excessive loss of water noticed will warrant carrying out the remedial measures. It serves the purpose of a correct diagnosis of the problems faced in order to arrive at optimum solutions. It may also prove an effective tool for realistic understanding and assessment of the present performance level of the service for future expansion.

Domestic Sector: Domestic water requirement is estimated to nearly double in the next 40 years (56 BCM in 2010 to 102 BCM in 2050 (MOWR, RD & GR 2000). The ever rising scarcity has put the managers in a bracket and left with no choice but to critically review and optimize the business as usual. The typical reasons water supply system under-performance could be like

poor conservation, inefficient management, improper operation and maintenance system, lack of revenue generation (poor metering; low tariff), and most significantly, wastage due to leakage and pilferage etc. Leakages and unaccounted use must be controlled and brought to the minimum level. Unfortunately, unaccounted-for-water also constitutes a significant fraction of total water supplied in poorly managed water transmission and distribution systems. Measures like detection, control and prevention of leakage, metering of water supply, installation of properly designed waste-not-taps and prompt action to repair and maintain distribution system components should be adopted. This can be achieved through water audit.

Industrial Sector: Though the industrial water demand (including energy demand) at present constitutes only about 8% of the total water demand, its share of water use is rising rapidly and by the year 2050 is expected to increase to about 13% of the total projected water use at that time. The overall demand of water for industries is expected to go up from 56 BCM (including Energy, mainly Thermal Power) that was in the year 2010 to 151 BCM by the year 2050. At present the industrial plants in our countries consume about 2 to 3.5 times more water per unit of production compared to similar plants operating in other countries. There is an urgent need and scope to make the systems more efficient and operate with reduced quantity of water. Further unlike in Irrigation the industries require water on regular basis throughout the year. Therefore, to ensure reasonable availability of water for industries even during the lean periods, the industries will have to inculcate the habit of efficient water use. Besides this, industrial water management has to address a major

issue of water quality of effluents which can also be tackled to some extent through efficient water use. The principle of 'Reduce-Recycle-Reuse' has to be implemented to avoid contamination of fresh water resources. For industries water audit becomes key for reducing the water usage as well as effluent management to avoid fresh water contamination.

The National Action Plan on Climate Change was formally launched on June 30th, 2008. The NAPCC identifies measures that promote development objectives while also yielding co-benefits for addressing climate change effectively. The eight missions are

- National Solar Mission
- National Mission for Enhanced Energy Efficiency
- National Mission on Sustainable Habitat
- **National Water Mission**
- National Mission for Sustaining the Himalayan Ecosystem
- National Mission for a Green India
- National Mission for Sustainable Agriculture
- National Mission on Strategic Knowledge for Climate Change

serves as an important step towards improved water conservation and, linked with the implementation of a water loss reduction plan, can save the water system a significant amount of money and time.

Benefits of Water Audit

Water audit improves the knowledge and documentation of the distribution system, problem and risk areas and a better understanding of what is happening to the water after it leaves the source point. Leak detection programs help in minimizing leakages and tackling small problems before they become major ones.

Leak Detection Programs lead to

- reduced water losses
- improved financial performance
- improved reliability of supply system
- enhanced knowledge of the distribution system
- efficient use of existing supplies
- better safeguard to public health and property
- improved public relations
- reduced legal liability
- reduced disruption, thereby improving level of service to customers.

WATER AUDITING

What is a water audit?

A water audit is conducted to determine the amount of water lost from a distribution system due to leakage, storage overflow, meter malfunctions, and theft. Audits are also used to estimate the cost associated with these losses to the water system by balancing the amount of water produced with the amounts billed. Comprehensive audits can provide the water system with a detailed profile of the distribution system and water users, allowing for more effective management of resources and improved reliability. Water auditing

Elements of a water audit

- A record of the amount of water produced
- A record of the amount of water delivered to metered users
- A record of the amount of water delivered to unmetered users
- A record of the amount of water loss (balance of water, including leaks)

Water Losses

There are two types of water losses, real and apparent. Real water loss includes water lost through leakage in distribution systems, service connections, and storage tanks (including overflow). Apparent loss includes

Common causes of leakages

- Corrosion
- Excess pressure
- Temperature variations
- Seismic activity
- Lack of regular maintenance
- Excessive traffic loading
- Poor design/installation
- Inappropriate backfill
- Pressure transients/fluctuations

meter and record inaccuracies and unauthorized water uses such as theft or unauthorized connections. Authorized unmetered uses are a special type of water loss, and should be carefully estimated as these losses can represent a significant source of lost revenue.

Conducting a Water Audit

Audits are completed by calculating the difference between the amount of water produced and the amount sold (metered sales), and then addressing the difference. Metered sales are compiled and the remaining difference between produced water represents water lost. An audit records the amounts of water produced, the amount delivered to metered users, the amount delivered to unmetered users, and water loss, along with likely causes for the unaccounted water. Finally, the results are analyzed and estimates are made for recoverable leakage.

General steps for conducting a water audit

- 1) Set an evaluation period –usually the previous calendar year
- 2) Working out the measured parameters
- 3) Compile water production, water purchased (if any), and sales (metered) data
- 4) Make adjustments to the metered amounts, as necessary
- 5) Compile the summary for water delivered and used
- 6) Determine whether water loss exceeds 10% of the total amount produced. If so, follow up by developing a water loss reduction plan.

IoT for Water Auditing

In order to achieve the desired output from a water audit, it is extremely important to have accurate and timely measured data for evaluation of losses. In the age of growing application of sophisticated concepts like Internet of Things and Artificial Intelligence, it becomes quite simple to establish a system in which a reliable set of real-time data can be acquired using appropriate instrumentation and metering. This data can further be processed to establish the water audit findings.

The system can not only be used for identifying the losses but knowing all the qualitative and quantitative parameters of raw water, treated water and waste water in order to enable the users and auditors to assess the real-time status of water usage. This will also generate enough data for the decision makers. The monitoring system can facilitate the establishment of baseline, targeting and controlling the water usage, thus proving to be a complete water management solution.



Amol Chiplunkar
Certified Energy Auditor

Amol is a graduate Production Engineer. He has completed his post-graduation in Energy (MTech Energy) from University of Pune. He is a Certified Energy Auditor (EA-10856) under the BEE Scheme for Certification of Energy Auditors. He is a Certified Lead Auditor for ISO 50001 Energy Management System.

Amol has experience of about 19 years in energy and environment. He is working as a freelance consultant for last 14 years. He can be reached on aacecpune@gmail.com.