

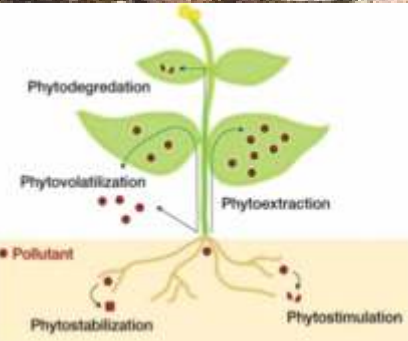
MARCH 2017

VIEWPOINT

OFFICIAL QUARTERLY MAGAZINE OF CEAI

www.ceai.org.in

Water and Sustainability



Consulting Engineers Association of India

... creating value for engineers

Seminar

7th April 2017 | Multipurpose Hall
India International Centre, New Delhi

Ports & Industrial Corridors

PORTS & INDUSTRIAL CORRIDORS AS ECONOMIC DRIVERS

India has set itself a target goal of boosting exports from current USD 465 billion in 2014-15 to USD 900 billion by 2020. Discrete manufacturing clusters aim at supporting this aspiration with strong linkages to existing and announced clusters and corridors, e.g. Delhi-Mumbai Industrial corridor, Vizag-Chennai Industrial Corridor, other corridors being developed by Department of Industrial Policy & Promotion (DIPP). Port-based or port-proximate manufacturing can play a pivotal role in boosting trade. The smart Port cities, and Port-based special economic zones are emerging as new areas of growth. Overall, significant opportunities exist for developers, contractors and technology and equipment providers, particularly in light of the Sagar Mala, Make in India and other prominent government initiatives.

CONFIRMED SPONSORS

JSW Infrastructure

ITD Cementation India Ltd

SPONSORSHIP FEE

Platinum	₹ 2,00,000/-
Gold	₹ 1,00,000/-
Silver	₹ 50,000/-

ADVERTISEMENT TARIFF

Back Cover	₹ 25000/-
Inside Back Cover	₹ 20000/-
Inside Front Cover	₹ 20000/-
Full Page	₹ 15000/-
Half Page	₹ 10000/-
+ Service tax@ 15% / as applicable	

TALKING POINTS

- Connectivity and Logistics
- Port based SEZ and Industrial growth centres
- Corporatization, upgradation, strengthening, capacity building, green initiatives, smart ports.
- New trends in Terminal Automation
- Capacity optimization and Congestion Management – how is the port sector responding?
- Port Connectivity and the Inland Waterways solution
- Coastal Shipping outlook and implications for port capacity
- Development of Special Economic Zones and Road/Rail Linkages
- Bidding for Port PPP Projects in India

WHO ATTENDS

THE SEMINAR WILL ATTRACT MARITIME PROFESSIONALS, GOVERNMENT LEADERS AND INDUSTRY EXPERTS FROM AROUND THE COUNTRY

Major and minor ports	Logistics companies
Shipping companies	Contractors
Private and public port operators	Investors/Private equity firms
Consultancy organisations	Banks and Financial institutions
Maritime boards	Technology providers
Equipment manufacturers	Freight forwarders & transporters
Industrial corridor corporations	Engineers & technocrats
Government Agencies	Logistics & warehousing

PAPER / PRESENTATION: Those who wish to present a paper at the Seminar are requested to send an abstract of the paper in soft copy (in not more than 500 words), by March 15, 2017 along with their profile and photographs. Selected authors will be required to submit full text of their papers by March 24, 2017.

SUPPORTED BY



Sagarmala of Ministry of Shipping



Confirmed SPEAKERS

Mr A R Rao, PIANC
Mr H S Ashwat, Ministry of Shipping
Mr Atul Kulkarni, IPA
Mr Abhishek Chaudhary, DMICDC
Mr Nagarjuna Tadury, GMR
Mr R R Patra, JSW Infrastructure
Mr Anilkumar, CH2MHill
Mr Devdatta Bose, TCE

Also speakers expected from Sagarmala, Container Corporation of India, Dedicated Freight Corridor Corporation of India, IIT Madras, National Highways Authority of India, IIDC

The mission of this seminar is to highlight the new and emerging opportunities in the Indian ports and new & existing Industrial Corridors, examine the key challenges and discuss appropriate solutions. The seminar will also showcase noteworthy initiatives/ projects and the most promising technologies/ solutions

REGISTRATION FEE

CEAI Members ₹ 3000/-
Non Members ₹ 4000/-

+ Service Tax @ 15% / as applicable

ORGANISER

Consulting Engineers Association of India (CEAI) is an apex body of consulting engineers of about 500 members both private and public sector firms. It is the only Indian member association representing the consultancy fraternity at the International Federation of Consulting Engineers (FIDIC), the global forum of consulting engineers. The mission of CEAI is to promote consulting engineering profession nationally and internationally and upgrade engineering knowledge and skills. **For details, please see www.ceai.org.in**

For more information

Tel: 91-11-26134644, Telefax: 91-11-26139658

Email: ceai.ceai@gmail.com, info@ceai.org.in ; Website: www.ceai.org.in

MARCH 2017

VIEWPOINT

OFFICIAL QUARTERLY MAGAZINE OF CEAI

www.ceai.org.in

CONTENTS

- 1 From Chief Editor's Desk
- 3 Water and Sustainability
- *Bhaskar Sengupta*
- 6 Water Loss - A Major Threat To The Water Industry
- *G.N.Virupaksha & K.T.Veerabhadra Swamy*
- 9 Conserving Water
- *Arvinder S Brara*
- 10 Wastewater including Storm Water and it's Management
- *N. Purnachandra Rao*
- 16 Strengthening Water Resiliency through Recycled Water
- *Sangeeta Gupta & SonikaVadhera*
- 22 Constructed Wetlands
- *Dr. Dinesh Kumar & Dr. V. C. Goyal*
- 25 Industrial Water and Sustainability
- *D V Saraiya*
- 29 CEAI News
- 38 FIDIC News
- 39 Other News, Views & Notes

EDITORS BOARD

Chief Editor

Mr A P Mull, Chief Editor

Members

Mr Sudhir Dhawan
Mr Somenath Ghosh
Mr R Khazanchi
Mr Pradeep Chaturvedi

Dr S Chatterjee
Mr AlokBhowmick
Mr R Gogia
Mr L D Gupta

COMPLETE SOLUTION

FOR THE CONSTRUCTION INDUSTRY



All you need in civil engineering applications

- Integral Water Proofing Compounds
- Surface Applied Water Proofing Coatings
- Tile Fixing Adhesives And Joint Fillers
- Structural Repair Products
- Stone, Granite & Marble Enhancer
- Bonding Agents
- Plasticisers
- Flooring Products
- Industrial Coatings



AN ISO 9001 : 2008 & NSIC - CRISIL SME - 1 RATED COMPANY



Member - CCMA



PERMA CONSTRUCTION AIDS PVT. LTD.

611 / 612, Nirmal Corporate Centre, Mulund (W) Mumbai - 400 080, India.

Tel.: 91-22-2591 8911 / 2567 4690 • Fax : 2590 3008

E-mail: info@permaindia.com • Visit us at www.permaindia.com



Indian Green Building Council
MEMBER



MESSAGE FROM CHIEF EDITOR

Dear Fellow Consulting Engineers,

The new Financial Year is expected to open the gates of more and new projects for the sustainable development of the country. They will present opportunities for the Engineering fraternity to innovate and showcase their talented capability based on years of experience.

The political scenario in parts of the country as well as the world is changing and that would also bring in challenges as well as opportunities which should be taken up and successfully addressed to prove the mettle of our fraternity.

The current shibboleth is "*SmartCities*". What should that really entail? Would mere automation through digitization or virtualization be adequate? These cannot be an end in them self but are mere means to get the drudgery out and make certain functions less manual so as to enable better utilization of human potential. However, let's give a thought to the services and utilities that are fundamental to our existence - nay life itself without which no "Smart Cities" can exist.

Air - a prime requirement which is being badly affected because of the pollution generated by mechanisation. It is not that mechanisation is to be shunned, but what is required is to urgently address the negative outcomes and minimize or eliminate them in a more aggressive and pervasive manner. The dust or fume or exhaust or the venting system needs the requisite filters, precipitators, scrubbers, etc. to prevent the atmosphere from being polluted. The same applies to digitization. The electro-magnetic forces being generated by digitization also need to be addressed and not just wished away.

Water - that's the second prime requirement. It's not only India but other countries also which are water stressed. Certain parts of our country have abundant water whereas others face droughts. The natural water sources need to be preserved and nurtured. The wastewater also must be treated and recycled by means that are effective and at least cost. The industrial effluents should be segregated by improving and incorporating in the process such steps that extract the unwanted from the effluent. Recovery or removing of metals is another area of importance especially in the mining and metals industries. For domestic waste water, plants in nature offer ways that it can be cleaned. It's such treatment that needs to be encouraged and promulgated. It can be done on small and large scale and thus take the load of urban bodies to build and operate large wastewater treatment systems. Another method that's been developed is using natural sunlight and a photo catalyst. Those

in the field need to track this development. Zero Discharge must be enforced, except when there is a need to maintain minimum flow in water bodies.

Storm water is another major issue that must be addressed on a war footing. The loss to life and economy every year due to inundation and floods is enormous. There is a need to develop Master Plans and design storm water drainages not only in urban areas but also those prone to deluge from storms. With proper implementation great relief could be achieved and life and economic loss obviated plus prevent sickness and epidemics.

Food - the third requirement for sustaining life also leads to generation of solid waste. Dealing with that is another mega task. Here also by segregating the waste and breaking down its disposal, area wise and even community wise - this task, especially of the wet garbage, could be made more manageable and reduce requirements of large city/town dump areas.

This issue deals with Water and Sustainability. Engineers must work in close coordination with the policy makers and the executive officials to make all areas of the country self sufficient in water for domestic usage, agricultural purpose and also industrial.

ENGINEERS - TAKE UP THE GAUNTLET, INNOVATE AND ACHIEVE

Happy Reading and Learning



A P Mull

Water and Sustainability



Bhaskar Sengupta

Cell In-Charge of Green and Water & Environment Technology Centre -
a division of Development Consultants Private Limited (DCPL)

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” - Brundtland Commission (1983)

Abstract- Problems in sustainable water resources management and water services are not due to a lack of tools, but from the selection and application of appropriate tools to support decision-making on policies and investments.

Leaders and specialists in the water resources sector need to work very closely with the decision-makers to make better decisions to achieve the target of sustainability in water resources and its service delivery.

I. Introduction

In December 2016, the United Nations General Assembly unanimously adopted the resolution “International Decade (2018–2028) for Action – Water for Sustainable Development” to help put a greater focus on water during the decade.

Emphasizing that water is critical for sustainable development and the eradication of poverty and hunger, UN Member States expressed deep concern over the lack of access to safe drinking water, sanitation and hygiene and over water related disasters, scarcity and pollution being exacerbated by urbanization, population growth, desertification, drought and climate change.

The new Decade will focus on the sustainable development and integrated management of water resources for the achievement of social, economic and

environmental objectives and on the implementation and promotion of related programmes and projects, as well as on the furtherance of cooperation and partnership at all levels in order to help to achieve internationally agreed water-related goals and targets, including those contained in the 2030 Agenda for Sustainable Development.

In the resolution, UN Member States invited the Secretary-General, with the support of UN-Water, to take appropriate steps, within existing resources, to plan and organize the activities of the Decade at the global, regional and country levels. To set the agenda in motion, UN-Water, in its 26th meeting in Geneva in February 2017, decided on the establishment of a Task Force to facilitate its support to the planning and organisation.

The Decade will commence on World Water Day 22 March 2018, and terminate on World Water Day, 22 March 2028.

The Government of India, through the Department of Drinking Water and Sanitation, has already taken significant steps to meet this challenge through the National Rural Drinking Water Programme (NRDWP). A strategic plan was set out by the Department of Drinking Water and Sanitation in the rural drinking water sector for the period 2011 to 2022.

The objective of the plan is to enable all rural households to have access to piped water supply in adequate quantity

with a metered tap connection providing safe drinking water, throughout the year, that meets prevalent national drinking water standards, leading to healthy and well-nourished children and adults and improved livelihoods and education. Continuous uninterrupted water supply is an aspiration and efforts need to be made to cover increasing numbers of habitations with 24x7 water supply.

By 2022, every rural person in the country is expected to have access to 70 lpcd within their household premises or at a horizontal or vertical distance of not more than 50 meters from their household without barriers of social or financial discrimination. Individual States can adopt higher quantity norms, such as 100 lpcd. It is recognized that States will adopt their own strategies and phased timeframes to achieve this goal.

Three standards of service have been identified depending on what communities need:

- Basic piped water supply with a mix of household connections, public taps and handpumps (designed for 55 lpcd) - with appropriate costing as decided by States taking affordability and social equity into consideration.
- Piped water supply with all metered, household connections (designed for 70 lpcd or more) - with appropriate cost ceilings as decided by States taking affordability and social equity into consideration.
- In extreme cases, handpumps (designed for 40 lpcd), protected open wells, protected ponds, etc., supplemented by other local sources – preferably free of cost.

Optimum use of rainwater should be an integrated element in all the three cases.

One of the most critical challenges in this sector is to secure an adequate source of water in terms of quantity and quality. Since 1947, with increasing growth of the population the per capita water availability has fallen from over 5000 m³/year to about 1700 m³/year. This is due to massive over-exploitation of groundwater mostly to meet irrigation demand and increasing scarcity in drinking water during summer months. The status of groundwater

development is more than 100% in the States of Delhi, Haryana, Punjab and Rajasthan. More than 15% of the total blocks in the States of Andhra Pradesh, Delhi, Gujarat, Haryana, Karnataka, Punjab, Rajasthan and Tamil Nadu are over-exploited or critical in terms of ground water development. Due to deeper drilling of aquifers, drinking water sources are increasingly becoming contaminated with natural contaminants like fluoride, arsenic and salinity.

Implementation Plan for Source Sustainability Issue has been drafted by Government of India as follows:

- 1) Sustainability Plans should be prepared especially for over-exploited, critical and semi-critical blocks for taking up scientifically located recharge measures and water harvesting structures on a watershed or aquifer basis. These would be prepared using Ground Water Prospects (HGM) maps, GIS and GPS techniques to ensure maximum water conservation to benefit drinking water sources in a cost effective manner. These plans should be financed by convergence of NRDWP Sustainability MNREGS as well as Watershed Development Programmes.
- 2) The GP/ VWSC should plan, prepare and implement Source sustainability water harvesting and groundwater recharge measures for all existing sources of drinking water schemes, wherever feasible and required using Groundwater Prospects Maps.
- 3) All plans and estimates of new schemes for drinking water supply should include provision of source sustainability measures, wherever feasible and required using groundwater prospects maps and GIS tools.
- 4) Community management includes measuring water tables using simple or automated rain gauges and rope measures and preparing a water budget to match demand (especially for irrigation) and available water.
- 5) Water harvesting and groundwater recharge structures should be planned on watershed basis and

adopted to augment available water. However, hydro geologists should assess overall impacts of reduced runoff including reduced inflows to tanks.

- 6) The GP/ VWSC should also rehabilitate and develop traditional village tanks, ponds and wells.

Sustainability of drinking water sources is probably the most important factor determining whether a rural drinking water supply system will function satisfactorily for an appreciable length of time. Interventions to ensure source sustainability include Software inputs (raising awareness on need for recharge, avoiding water wastage and the need to plan for balancing availability and consumption) and Hardware inputs (Building physical structures which can capture rainwater and surface water runoff, and/ or help recharge ground water like check dams, subsurface dykes, etc.).

By 2022, India may have moved to upper-middle income country status with the third largest economy in the world behind only the USA and China. Though economic growth is expanding access to resources and opportunities for increasing numbers of educated people coming from rural, small town and urban backgrounds it is evident that many areas of the country and many sections of the population are unable to access the opportunities available. The challenge is to sustain and broaden the scope of the growth process, to overcome the many inequalities that exist in urban slums and lagging rural areas, for SC/ ST, poor and marginalized households and habitations, and to

ensure that more people have better jobs, and better access to basic infrastructure and improved public services, like health, education, water supply and sanitation.

Problems in water resources management and water services do not arise from a lack of tools, but from the selection and application of appropriate tools to support decision-making on policies and investments. Tools are useful to facilitate dialogue between sector specialists and decision-makers. Leaders in the water sector – for example in water supply and sanitation, hydropower, irrigation and flood control – have long been aware that water is essential to sustainable development, but they generally do not have the mandate to make decisions on development objectives or the human and financial resources to meet them. These decisions are made or influenced by leaders in government, the private sector and civil society, who must learn to recognize water's role in obtaining their objectives. Therefore, leaders and specialists in the water resources sector should work very closely with decision-makers to make better decisions for true achievement of sustainable water resources and service delivery.

Reference Websites

- [1] <http://mdws.gov.in/>
 [2] <http://www.unwater.org/>
 [3] <http://en.unesco.org/>

SUEZ Confirms GE Water buy for •3.2 Billion

...in partnership with Canadian investment company Caisse de dépôt et placement du Québec (CDPQ), on a 70/30 split.

SUEZ intends to merge GE Water with its existing Industrial Solutions business and may have possible collaboration with its other business areas, such as recycling and energy recovery. The transaction is expected to close by mid-2017, subject to regulatory approvals.

Water Loss - A Major Threat To The Water Industry



G.N. Virupaksha¹, K.T. Veerabhadra Swamy²

¹Group Sector Head- Water, TATA Consulting Engineers Ltd., Bengaluru

²Deputy General Manager-Environmental, TATA Consulting Engineers Ltd., Bengaluru

INTRODUCTION

One of the major issues affecting water utilities is the considerable difference between the amount of water put into the distribution system and the amount of water billed to consumers – what is called as Non-Revenue Water (NRW) or Unaccounted for Water (UFW). Large volumes of UFW seriously affects the financial sustainability of water utilities due to loss of revenues and increased operational costs.

In a number of cities of the developing world, more than 40% of the treated water produced is lost before reaching the consumer. Hence, reduction of Unaccounted for Water (UFW) is a crucial requirement to improve the financial condition of water utilities and to save scarce water resources.

Where urban areas are situated in the proximity of a perennial source, little attention is paid to this scarce commodity. Where the dependence is on seasonal monsoon rainfall only, it becomes rather difficult to cope up with the needs. Therefore in locations where there is no scope for identification or development of additional resources, all efforts to conserve the available water become absolutely essential.

The different methods of conserving water are (a) Reduction in Unaccounted for Water (UFW), (b) Recycling of Wastewater, and (c) Rainwater Harvesting.

This paper discusses about reduction of UFW and a Case Study is presented.

UNACCOUNTED FOR WATER

The components of Unaccounted for Water (UFW) are:

- a) Physical losses: Leakage from reservoirs, trunk mains and distribution system.
- b) Non-physical losses, which include:
 - (i) Errors in supply measurement,
 - (ii) Consumer meter errors,
 - (iii) Errors in estimates of un-metered consumption,
 - (iv) Unmeasured authorized use,
 - (v) Illegal use of water,
 - (vi) Unmetered waste, and
 - (vii) Administrative errors.

Estimation of UFW involves measuring the flow into the system and the consumption in the system over a definite time period. It thus involves installation of flow meter at the inlet and outlet points of the area. The other component of flows measurements are at the consumers end. They give the accountability of physical losses (leakage) in the system.

The non-physical losses in the system are assessed by use of calibrated meters, checking sample of the consumer meters for under-registration, proper assessment of unmetered consumption (a sample of consumers in each category should be taken to make the consumption estimate as accurate as possible).

FACTORS INFLUENCING LEAKAGE IN WATER SUPPLY SYSTEM

The larger losses are usually from the sudden rupture of a joint, whereas lower level losses are from leaking joints, fittings, service pipes and service connections. The volume lost depends largely on the pressure in the system and the time taken for repairs. The factors that influence the leakage in the water supply system are:

- *Pipe Condition*
- *Poor Quality Materials, Fittings and Workmanship*
- *Pressure in the System*
- *Soil Characteristics and Traffic Loading*

IMPACT OF LEAKAGE

The effects of leakage of water in a water supply system are:

- *Damage to Infrastructure*
- *Consumer Problems*
- *Financial Losses*
- *Health Risks*

LEAKAGE MEASUREMENT

The leakage in the water supply system can occur in reservoirs, trunk main and distribution system. Although leakage in reservoirs and trunk mains could be significant, the majority of leakage occurs in the mains and service pipes of the distribution system. About 80% of the water is lost in the distribution system i.e. through mains, pipe joints, stand posts, valves, consumer connection and service pipes. The procedure adopted for leakage measurement depends on the supply arrangement and supply duration (continuous or intermittent supply).

Leakage from reservoirs is measured by conducting a water level drop test. For Trunk Mains, flow meters are to be installed at the inlet and outlet of the main selected for tests. In the distribution system there are two methods available – Tanker Method and the District Metering Area (DMA) Method.

LEAK LOCATION

The three methods of leak location most commonly used are (1) Step Testing, (2) Sounding and (3) Leak Noise Correlation

WATER AUDIT

A water audit identifies the quantity of water lost and its costs. Records and system control equipment are checked for accuracy. The overall goal of the audit is to help the authority to select and implement programmes to reduce the distribution system losses.

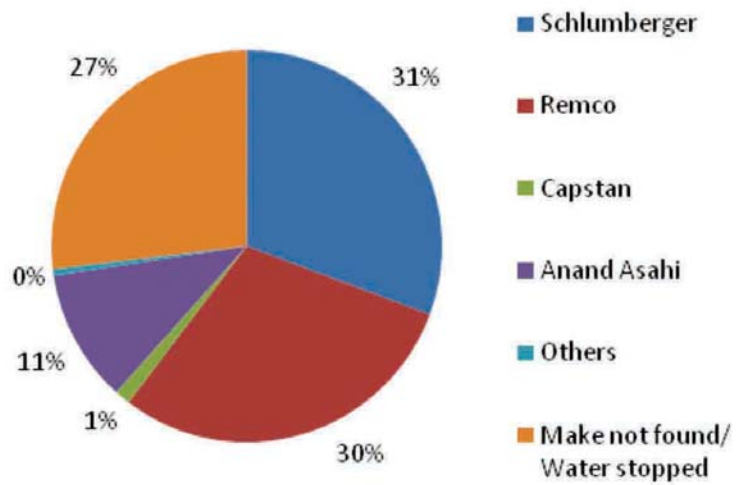
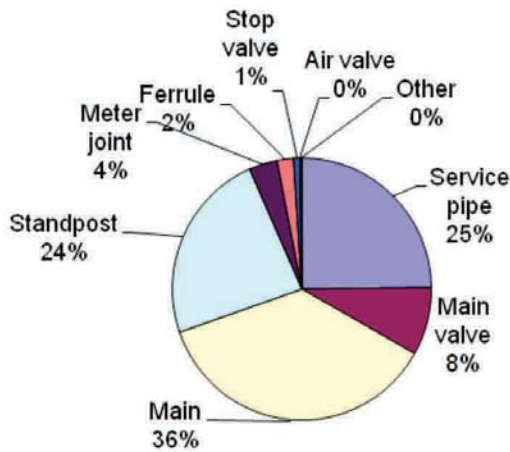
Water audits should be performed annually to help managers adjust priorities, monitor progress, identify new areas of system losses and establish new maintenance goals. Updating a water audit is usually less expensive than the original audit.

CASE STUDY

Bangalore Water Supply and Sewerage Board (BWSSB) is responsible for providing safe drinking water and management of waste water in the Bangalore Metropolitan Area of about 800 sq.km. The main source of water for Bangalore is the river Cauvery, about 100 km from city. The static difference between the location of the treatment plant and the average elevation of the city is about 300 m; the pump head is about 450 m. The cost of energy is a major component of the O&M costs.

The water distribution system in Bangalore is around 100 years old hence in some areas and it is understood that the UFW is about 38%. As a start towards reducing UFW, BWSSB initiated a pilot Project in the central areas namely, Austin Town, Shivajinagar, Johnson Market, Vasathnagar, etc as part of the Cauvery Water Supply and Sewerage Project, Stage-IV, Phase-I. This UFW reduction project covered 32,074 consumer connections in an area of 20 sq. km.

In this project, District Metering Area (DMA) method was adopted and water supply was constantly measured at strategic (inlet and outlet of DMAs) locations. In total 21 DMAs were created in the pilot area. The number of connections/ DMA varied from 500 to 2500 depending on the distribution network. Around 7,000 leaks were repaired over a period of 22 months in Phase I (Design and Implementation) and further 6,500 leaks were repaired over a period of 18 months in Phase II (Maintenance). Leaks were found in service pipes, main valves, standposts, meter joints and ferrules and other locations. The percentage of these leaks in the project area are presented in figure.



All the consumer connections were surveyed in order to assess the type and condition of the meter. Most of the meters were of Class-A, and had been replaced with Class-B in order to increase accuracy of measurement. Classification of consumer meters as surveyed is presented in the figure.

DMA meters were full bore electromagnetic flow meters

and the consumer meters were replaced wherever necessary depending on the performance of the meters on the test bench.

This project has resulted in an overall decrease in leakage of 26% from an original average level of 56%. The average billing has increased to (about 9%) 1027.75 ml/month from 936.26 ml/month as per the BWSSB billing data record of 2008-09.

CONCLUSIONS

Based on above it is evident that implementation of leakage control programmes is a must for municipalities/ water authorities.

The choice of technology for leak detection and control varies from system to system. The choice of methodology is largely dependent on financial constraints on equipment and other resources. A low activity method, such as repair of visible leaks only, may be cost effective in supply areas where water is plentiful and cost of production is cheap. On the other hand, where cost of production and supply is high a much higher level of activity such as flow monitoring or even telemetry systems to warn of a burst or leakage is required.



Installation of Consumer Meter



Installation of DMA Meter



District Meter Cabin and display unit



Leak Repair using Clamp

Conserving Water

How Every Citizen Can Help to Conserve Water in the National Interest



Arvinder S Brara

Chairman & Managing Director, Mantec Consultants Pvt. Ltd.

As is well known India has been categorized as a water scarce country in terms of overall availability of water per capita. We are all aware that rivers are drying up, ground water table is falling and people in villages still walk many miles for water. Water is a precious and scarce resource to be utilized without wastage. As a responsible citizen you can help in water conservation by doing the following:

1. **Bathing:** Instead of a shower or running water use a bucket and mug to have a bath as that uses much less water and serves the purpose equally well. If you do have a shower please do not keep the water running while applying soap/ shampoo.
2. **Brushing:** Close the tap when not in use or better still use a mug.
3. **Vehicle washing:** Instead of a hose pipe use a cloth and bucket of water to clean the vehicle.
4. **Floor washing:** Use a wet cloth or mop to clean the floor instead of a hose pipe or running water to wash the floor.
5. **Gardening:** Use a sprinkler can or drip irrigation technique for gardening large areas and for plants and lawns instead of hose pipe to flood the area to be watered.
6. **Toilet Flushing:** Use smaller tanks or put a brick in your large water tank to reduce the water storage and quantity used in every flush.
7. **Leaking taps, faucets, valves, etc:** Have the tap, faucet, valves, or any other fixture or pipe attended to so that there is no water leakage.
8. **Close taps fully:** It is often found that taps in wash basins, baths, WCs, public spouts/ taps, etc. are not closed fully and water keeps dripping from them. Please take care to close all taps fully so that there is no wastage of water. Draw attention of the person on duty in public areas if the item is not functioning properly so as to avoid wastage.
9. **Washing Clothes/ Dishes & Utensils:** Washing machines and Dish washers help to not only reduce the daily house chores but also help to economise on usage of water.
10. **Rainwater Harvesting:** Please study and implement to collect rain water and use it to recharge the ground water or store it for appropriate use.
11. **Recycling sewage:** Encourage your RWAs to install sewage recycling facilities in parks, using root zone treatment to recycle and use that treated waste water for gardening.
12. **Encouraging Builders to recycle sewage:** While considering buying a plot or flat from any builder encourage them to recycle sewage for using treated waste water for gardening rather than over load the existing sewage system by simply connecting the sewage from the development to the sewer. Alternately encourage builders to use soak pits for natural treatment of sewage rather than adding to the sewer. Zero discharge should be the goal

It is the duty of every citizen and each one of us to play an active role in water conservation to avoid wasting water and treating it as a precious and scarce resource by acting on the above in our day to day lives.

Wastewater including Storm Water and it's Management



N. Purnachandra Rao

GM & DTCH (Water & Wastewater), Tata Consulting Engineers Ltd.,
Mumbai

Introduction

This paper is to enable better understanding of the various gaps in this sector and thus help in filling them with a proper techno-economic approach for helping this sector develop on a sustainable basis in a fast track mode.

The Surface Water Resources, mainly the river basins in India and also elsewhere, are under tremendous stress with the basins depleting and leading to moderate to severe water shortage. The shortage is mainly due to combined effects of growth in agriculture, industrialization, living standards of rural and urban folks, urbanization, etc. The Ground Water potential is also depleting. Disposal of untreated domestic sewage and industrial effluent is a potential threat for reduction in availability of fresh water.

An estimated 38,354 million litres per day (MLD) of sewage is generated in major cities of India, but the sewage treatment capacity is only of 11,786 MLD¹. Similarly, only 60% of industrial waste water, mostly from large scale industries, is treated. It is interesting to note that the estimated present water demands for Irrigation, Drinking Water, Industry and Energy including other miscellaneous requirements are 22,00,000 MLD, 1,76,000 MLD, 47,000 MLD and 1,96,000 MLD respectively, hence the total water demand is 26,19,000 MLD where as the total utilisable water resource in the country has been estimated to 30,75,435 MLD which is also just 28% of the water derived from precipitation.¹

Out of the total demand of 26,19,000 MLD, the present utilization by various sectors is substantially low as substantiated by the fact that:

- (i) Though 24x7 water supply is being tried or demonstrated in certain selected zones of cities, none of the Indian cities including corporations have complete 24x7 water supply.⁶
- (ii) the present Indian rural water supply does not even touch 70 lpcd vis-à-vis the demand of 135 lpcd as considered for estimation of drinking water demand,
- (iii) the Indian farmers are facing severe shortage of water for irrigation purpose, and
- (iv) the Indian industry is also facing shortage of water, etc.

All this shows that Storm Water Management in India needs to be urgently addressed. It is important to note that due to various developments and activities in the river basins, a lot of storm water is wasted to the sea. Besides, considerable reduction of on site detention or retention systems every year leads to increased discharges into sea. There is another common factor – high variations in availability of storm water across the various regions in the country. The future demands by 2050 are estimated to be around 452,000 MLD for drinking and industrial purposes, but the fresh water availability per person per year has depleted from 5,177 m³ in 1951 to 1,588 m³ in 2010¹. Hence, there is a lot of thrust/ demand for proper treatment and utilization of sewage and industrial effluents in addition to considerable improvement in storm water management failing which the present and future society may be forced to face moderate to severe water crisis. For sustainable development and for making this basic need available, there should be stringent ultimate target of:

- (i) providing appropriate collection system of sewage and industrial effluent across the country and treating 100% to standards prescribed for various designated uses, and
- (ii) development of complete storm water collection system in all river basins and major and minor water tank basins with proper on site recharge pits along with detention and retention systems. A manual of practice on Storm Water Drainage and Management in India (presently under preparation by CPHEEO/MoUD) is an urgent requirement to improve the ground water recharge in the catchments, address floods and flash floods that occur downstream, water shortage in the catchments so that proper development of catchments is done to sustain the environment.

WASTE WATER MANAGEMENT FOR REDUCING THE FRESH WATER SHORTAGE

Sewerage & Industrial Effluents

Of the two systems for Waste Water Collection and Disposal, the Separate Systems is preferred due to its technical and economical advantages. In India also, nowadays almost all the sewer networks are designed for Separate Systems.

Almost 80% of India's population does not have proper sewer systems²² National Family Survey -3: 2005 – 2006³CPHEEO Manual on Sewerage and Sewage Treatment Systems (2013)⁴CPHEEO Manual on Water Supply & Treatment (1999). For example, 86 towns out of 124 towns in the former Andhra Pradesh State have neither any sewer net work nor water supply with at least 75 lpcd. Even under the Swachh Bharath Mission also it is observed that as per the 2011 census around 8 million households of the 4,041 statutory towns in India have no access to toilets and continue to practice open defecation. Sanitation facilities are absent in rural areas, where around 69% of India's population resides.

Consideration of Peak Factor as per Babbitt's formula for PE<10,000

In most cases networks in India are also not being designed on the basis of proper techno-economic considerations. In India, the CPHEEO Manual specifies

that the maximum peak factor be adopted as 3 for a population range up to 20,000³. It is not clear as per CPHEEO Manual whether the variable peak factor should be used for each sewer line in the network as per the population load assigned to that sewer. Most of the other countries adopt the peak factor as per Babbitt's formula (limiting to a maximum of 6) for population less than 10,000 while designing sewer networks. By adopting Babbitt's formula majority of the network designs would result in lesser sewer depths and also obviate the requirements of flushing of sewers during the maintenance. That is because, of around 70% (estimated based on the DPRs of ongoing projects) of any sewer network is loaded with population equivalent of less than 10,000 PE (population equivalent). Since there is considerable saving in the Sewer Net Work Cost (Capital Cost + O&M Cost) and technically it is appropriate to consider the Babbitt's formula, amendment to CPHEEO manual is urgently required. Consultants in India need to look into this post haste for the benefit of the drainage sector in India.

Proper selection of pipe material and usage

Various types of pipes - VCP, RCC, HDPE, DI, etc. are being utilised in the sewer net works based on various techno-economic considerations such as load bearing capacity of the particular class of pipes, various loads transferred on the pipes, least life cycle cost, internal pressure to be withstood, etc. At present, although VCP pipes upto 380 mm dia. are cheaper and suitable for gravity sewer application upto certain depths, and in any project the requirement of lower diameters upto 380 mm laid at reasonable depth is around 70% of the total network, the usage of these pipes is being reduced under wrong perceptions of less load carrying capacity, O & M issues, etc. On the contrary, these pipes are suitable for common loads in a major part of any network and hence are in general use in a number of sewer network projects around the world. A proper techno-economic analysis on project to project basis is a must for effective utilization of available funds for the sewer net work projects.

Provision of Manholes spacing

Manholes are a costly item and it is advantageous, costwise, to reduce the number of manholes to the extent possible. As per CPHEEO (2013), provision of manhole spacing along the street sewers (which are directly

connected to households) must not be more than 30 meters³. This guide line was based on manual cleaning for desilting of sewers and is being continued even though mechanical high tech cleaning systems are now being deployed. There is therefore a need of relooking at this criterion duly taking care of house service connections in the network.

Sewage Treatment Plants (STPs) and Effluent Treatment Plants (ETPs) and utilization of treated water

The current status on treatment and disposal of domestic waste water and industrial waste water presents an alarming scenario as seen from the table below.

Sl. No.	Description	Present Quantity in MLD	Future by 2050 in MLD
1.	Production/ generation of Domestic Waste Water (MLD) based on the existing collection systems and water demand.		
	Urban India	38,254	120,000
	Rural India	-	81,000
2.	Availability of proper Treatment and Disposal facilities for Domestic Sewage (MLD)		
	Urban India	11,786	
	Rural India	-	
4.	Production of Industrial Effluents (MLD)	13,468	47,138 *
5	Available proper treatment facilities for Industrial Effluents (MLD)	8,080	

Note: i.*The above values are from CPCB⁵.
 ii.* Estimated based on the Water Demand

As seen from the above table, there is a lot of gap between generation of waste water and treatment facilities available the discharge of which ultimately goes either to surface water bodies or seeps into ground waters and becomes the root cause for pollution of water

resources. Due to various developments all round the country, lack of focus on treatment and reuse of waste water coupled with growth of population, the per capita average annual fresh water availability has been reducing drastically, as mentioned earlier - from 5,177 m³ in 1951 to 1,588 m³ in 2010 and projected to be 1341 m³ in 2025¹.

In view of the above scenario, the main issues to be considered for improvement on a fast track are:

- Effluent standards for domestic sewage: Recently CPCB has prescribed 10/10 Mg/l for BOD/ SS discharge (to surface water) standards³. The International Standards on the other hand are upto a maximum of 10/20. Hence, there should be a detailed technical study for reviewing the standard so that more sewage could be treated with the same available financial resources.
- The domestic wastewater treatment using the constructed wetlands is suitable for isolated areas where the land cost is cheap. It may not be possible for following this treatment method for Urban India. However, the possibility to make it suitable for semi urban and rural India needs to be explored through techno-economic feasibility studies and then statutory guide lines established for its usages across the country at all suitable locations. Further the design criteria for the constructed wetlands need to be included in the CPHEEO Manual for putting this new technology in place so that all the associated advantages can be availed off and it would be useful for the sustainable development of the sector.
- Presently the waste water is put in use for various agricultural purposes in the country effectively utilising the potential presence of N and P in the waste water. But detailed research needs to be done on the complete process of growing and harvesting various crops for any direct and indirect health hazards and that study should be made available as a statutory guideline for consulting engineers and users of wastewater.
- Recycling of treated wastewater was an important revolutionary change in Wastewater treatment and disposal. However, serious commitment is necessary from statutory/ government bodies to convince the public for effective utilization of recycled water after undergoing tertiary treatment at STPs, by adopting

innovative methods for quick acceptance of using of recycled water. Statutory guidelines and making it mandatory for treating all wastewaters to the standard of recycling standard are a must.

- Presently a number of septic tanks are in use in Rural as well as Urban areas for treatment of domestic sewage. However, basic knowledge of maintenance of septic tank is poor among the users. In most cases, almost untreated water is being let out into the open drainage system from the septic tanks. Hence there should be a special drive disseminating knowledge among the users on O&M of septic tanks.

Storm Water Management

The total storm water availability per year and its proper utilization in is given in table below.

Sl. No.	Description of item	Estimated Quantity BCM		
		Surface Water	Ground Water	Total
1.	Utilizable Storm Water	690	433	1,123
2.	Presently made available to Irrigation			688
3.	Estimated Irrigation Requirement by 2050			1,072
4.	Water Demand for Drinking Water by 2025			73
5.	Water Demand for Drinking Water by 2050			102
6.	Water Demand for Industry by 2025			23
7.	Water Demand for Industry by 2050			63
8.	Total Water Demand by 2050 for various uses			1,447
9.	Deficient of Total Water availability by 2050			324

- Note: 1. BCM = Billion cubic meter = 2,739 MLD
 2. The total utilizable water resource in the country is 1,123 BCM which is 28% of water derived from precipitation.¹
 3. The above estimates are based on CWC, 2010.¹

From the above table it is evident that after reusing of the total domestic and industrial effluents (though practically it may not be possible) after undergoing appropriate treatment, there would be a water shortage gap of 183 BCM (5,01,162 MLD or 6,425 TMC) by the year 2050. Hence, it is essential to ensure that storm water be utilized upto the maximum extent and make its availability more than the present by adopting some innovative approaches.

The existing storm water management in India has failed and because of that large sums of money are being ill utilized directly or indirectly in the country in the form of loss to property, substantial loss of man-days due to frequent submergence, depletion of Ground Water Tables in the catchments due to absence of proper sustainable design concepts. The wastage or losses are attributed to:

- inundation of urban areas with many properties being submerged,
- man-hours being wasted; one day Urban India man-day cost considering a rate of Rs 200/day (average semi skilled labour as per SoR of few States has been taken, and 31% of total population of India has been considered) is around Rs. 8,000 crores,
- pollution due to frequent inundation of areas including damages to basic infrastructure, and
- depletion of ground water table in the catchments due to lack of statutory guide lines on onsite recharges.

The main culprit for today's status of Storm Water Management (SWM) is that a proper manual with design concept along with statutory guide lines for proper sustainable Storm Water Management is not in place. In addition there is apparently a lack of strong commitment of statutory bodies who are responsible for SWM.

There is no separate manual on SWM except for 4 to 5 pages with a very short description in the Sewerage Manual (2013). Two separate manuals from CPHEEO are available for Water Supply and Sewerage^{3&4}, each having more than 700 pages, but no separate manual exists for Storm Water Drainage Systems which is a prime component for infrastructure facilities. A small developing country like Malaysia has a comprehensive manual on

SWD. The manual on SWD in India is reportedly under preparation but it must be issued for use at the earliest.

Way Forward for SWD

In the absence of the SWD Manual the following basic approach/ concept is suggested to be followed for Sustainable Management of Storm Water Drainage Systems in India based on Zero Discharge Principle – the flow after development from the catchment should not be more than the flow before development.

A. The excess Q due to development (Q after – Q before) must be managed within the plot boundary (residential or commercial property) through Rain Water Harvesting Structures wherever soil permits or otherwise storage tanks should be provided. Few states are following partially by provision of recharge pits or “inkudu gunta” at plot level albeit without any kind of proper technical calculations.

By making this mandatory and with close monitoring on implementation:

- (a) the local ground water potential will be improved substantially,
- (b) the discharge from the plot to outside drain will be decreased by half to 1/3rd (< Q before) of Q after; hence reducing the Storm Water drain sections substantially,
- (c) reduce floods downstream and frequent flooding,
- (d) the issue of water scarcity at present / future would be addressed, and
- (e) control pollution in the area.

B. The excess Q due to development (Q after - Q before) in ROW area and Open area must be managed locally by providing detention/ retention/ RWHS before discharging through the out falls. The existing water bodies can be utilized or water bodies as detention or retention should be proposed along the drains and hence similar benefits as at (A) above could be achieved.

C. The Return Period/ ARI must be 5 years for starting drains, 10 years for medium drains , 25 years for major drains and 50 to 100 years for Streams and Rivers, as per International standard and should be

adopted. The return periods of ½ year, 1 year or 2 years for the storm water drainage design as per current CPHEEO (4 to 5 pages about SWM in Sewerage Manual³) is resulting in frequent submergence of areas and ultimately resulting in huge economic losses as well as life.

In addition to the above temporary silt traps with ARI of 6 months at all construction sites, wash troughs at ingress and egress of the site with temporary sedimentation tanks, etc. also need to be provided in SWM for controlling the sediments and also certain pollutants.

The above concepts need to be included in a manual of SWM from CPHEEO. If the manual is going to take time it is suggested that the responsible statutory bodies stipulate the points (A) to (C) above for effective implementation with immediate effect so that the urban suffering due to flooding is mitigated among other benefits of substantial improvement of ground water table while also addressing of major issue of water shortage.

Design criteria as well as rain fall data, sediment control systems in catchments, IDF curves for various areas, at least District wise, etc. should be made available in the proposed SWD Manual.

Thrust on QA and QC

For a proper and comprehensive study it is essential that all the steps starting from preparing Concept Reports to Commissioning of the systems be done through qualified and experienced resources and they be given the requisite and adequate time to do them. There should be detailed specification for a consultancy assignment, even to extent of adding micro level job requirements so that estimates for Mandays and other resources can be done correctly and on a uniform basis. All this would help in maintaining the quality of deliverables, complete monitoring of the project and maintaining project records to enable good operations and maintenance. Complete and proper specifications would go to minimise time and cost over runs of the projects.

Conclusion & Recommendation

The overall waste water sector including SWM in India will have sustainable growth that will even lead to resolving

water shortages across India and may stand as an example/ role model to the World provided all the shortfalls/ gaps discussed above are addressed with greater technical considerations and strong commitment by all the stake holders. The present available water resources should be fully utilised by adopting necessary innovative technical approaches in properly managing the Storm Water, Sewerage & Industrial Effluents so that it helps reduce the gap between real demand and supply plus control environmental pollution.

References

¹ Wastewater production, treatment and use in India by R. Kaur^a, S. P. Wani^b, A. K. Singh^c and K. Lal^a - ^aWater Technology Centre, Indian Agricultural Research Institute, New Delhi, India; ^bInternational Crops Research Institute

for the Semi- Arid Tropics, Hyderabad, India; ^cIndian Council of Agricultural Research, New Delhi , India.

²National Family Survey -3: 2005 – 2006

³ CPHEEO Manual on Sewerage and Sewage Treatment Systems (2013)

⁴ CPHEEO Manual on Water Supply & Treatment (1999)

⁵CPCB (2005a,2007a,2009) – Parivesh Sewage Pollution, Evaluation of Operation and Maintenance of Sewage Treatment Plants in India, Status of Water Supply, Wastewater Generation & Treatment in Class I cities and Class II towns of India.

⁶The World Bank Report on 24x7 Water Supply , Dt. 18-11-2014

IBM collaboration harnesses power of big data to help manage complex watersheds

A new data integration platform for watershed management is helping researchers, urban planners and others develop more sophisticated tools to predict floods, safeguard the drinking water supply and forecast the impact of urbanization on ecosystems.

Strengthening Water Resiliency through Recycled Water



Sangeeta Gupta¹, and Sonika Vadhera²

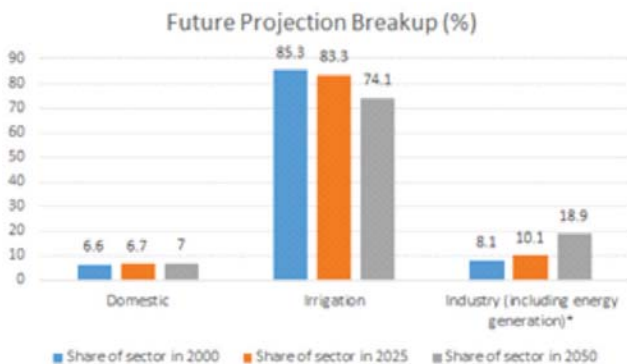
¹Associate Project Manager, CH2M India. Sangeeta.gupta@ch2m.com
Corresponding Author

²Water Engineer, CH2M India. sonika.vadhera@ch2m.com

Background and Introduction

India's urban population is growing at an unprecedented pace and within a decade, more than half of the Indian population is expected to be living in urban areas. Water is a crucial resource and water availability plays a very important role in the social and economic development of any country. With growing population, the per capita water availability in India has dropped from 1,816 m³ in 2001 to 1,545 m³ in 2011¹.

India has 16 percent of global population, but only four (4) percent of the global water resources². Water scarcity has become a major concern and the erratic rainfall patterns are bound to further intensify this crisis.



As far as water consumption is concerned, agricultural sector is the major consumer (85%) followed by industry and domestic sectors. In the future although, irrigation consumption is expected to fall down to 74%, it will still continue to dominate the water usage. However, the energy and industry usage is also expected to use up an increasingly greater share of total water used³.

Although, industries consume around ten percent of water, they are the worst affected during water crisis as the National Water Policy gives higher priority to drinking and agriculture usages over industries. Therefore, using freshwater for industries is not a sustainable approach as there is limited surface water availability and groundwater is overexploited. If this continues, major parts of India are expected to become highly stressed and unable to sustain everyday living, let alone support social and economic development.

Since industries are also given lower priority, any water supply cut by public utility leads to massive loss of revenues. Hence, industries need to look at a more holistic and resilient approach. This can be achieved by strengthening the water resiliency through development of an additional water source that is sustainable and viable.

Creating Water Resiliency

Resilience is the ability to reduce the magnitude and/or duration of disruptive events. The effectiveness of a resilient infrastructure or enterprise depends upon its ability to anticipate, absorb, adapt to, and/ or rapidly recover from a potentially disruptive event.

On the water supply side, diversification strategy is often considered the means to achieve resilience. Diversification implies incorporating a broad range of source options within a water system so that if one source is disrupted, others can help to compensate. The water resiliency has to be based on multiple sources of water in order to avoid dependence on a single water source.

Water recycling and reuse has proven to be successful in

various parts of the world to help solve their water problems. Singapore has been a pioneer in strengthening its water resilience by creating a diversified water portfolio to meet their water needs. This diversified water portfolio is commonly known as the **Four National Taps**. In integrating the water system and maximising the efficiency of each of the four taps, Singapore has overcome its lack of natural water resources to meet the needs of a growing nation and has created robust water resiliency.

Singapore Water Resiliency Story – An Overview

Water resources in Singapore are managed by one agency – Public Utilities Board (PUB).

PUB follows the principles of a closed loop water cycle and promotes its management philosophy through the **Four National Taps of Singapore's** program which are:

- **Local water** (water from local catchment) – Singapore has no natural water resources. Through a network of rivers, canals, and drains, the rain that falls on two-thirds of Singapore's land area is channelled to 17 reservoirs owned by PUB.
- **Imported water** – Under two bilateral agreements, Singapore has been importing water from Johor, Malaysia. The first agreement expired in August 2011. The second agreement is due to expire in 2061. Singapore plans to increase the dependence on a more sustainable source of water to compensate for imported water supply.
- **NEWater** (high quality recycled water) – NEWater, a pillar of Singapore's water sustainability strategy, is high-grade recycled water. Produced from treated used water that is further purified using advanced membrane technologies and UV disinfection, NEWater is ultra clean and safe to drink. Singapore's five NEWater plants meet up to 40% of the nation's current water needs. By 2060, NEWater is expected to meet up to 55% of Singapore's future water demands.
- **Desalinated water** – There are currently two desalination plants in Singapore with a combined capacity of 100 MGD which can meet up to 25% of Singapore's current water demand. The third desalination plant in Tuas is expected to be completed by 2017 and the fourth in Marina East by 2020. Desalinated water is expected to meet up to 30% of Singapore's future water needs by 2060.

Such solutions present an excellent opportunity to meet India's urban water challenge in an effective, resilient and sustainable manner. India can leverage on the Singapore experience and implement the concept of closing the water loop. This requires educating the public about the water cycle, create awareness about water recycling and thereby build credibility with customers and stakeholders which can be transformed into a trust, which must then be always maintained.

In India, the current status of used water generation and treatment capacity in Class I Cities (population more than 1 lac) including Metros (35 Nos., population more than 10 lacs) and Class II Towns (population less than 1 lac) is presented below⁴:



At present, most of the treated used water is discharged to rivers downstream with no specific end use. The treated used water is a resource that is not being used to its full potential. In addition to municipal wastewater, industrial wastewater can also act as another source of recycled water.

Types of Water Recycling

Water recycling on a large scale for an urban water supply can be divided into three key categories:

- **Non-Drinking Water Reuse (NDWR):** It involves the production of fit-for-purpose recycled water from wastewater which is then supplied to end users by a dedicated recycled water conveyance system for non-drinking uses such as boiler feed water, cooling tower water, outdoor irrigation, toilet flushing, etc. NDWR is preferred to the other two types because public acceptance is typically the most straightforward and easiest to achieve. A major downside of NDWR is the significant capital investment and operational burden of operating duplicated infrastructure. NDWR, however, can be an attractive option for Greenfield or new developments as well as industrial and commercial sectors. Projects involving NDWR have been initiated in various states of India such as Rajasthan, Maharashtra, Andhra Pradesh and others

- **Direct Drinking Water Reuse (DDWR):** The planned addition of highly-treated recycled water that is fit for human consumption by direct connection into the existing water conveyance system and delivery to the customers/ end users. DDWR is considered the least costly but most controversial of all the water recycling options
- **Indirect Drinking Water Reuse (IDWR):** The planned addition of highly-treated recycled water that is fit for human consumption by introduction to a bulk raw water storage or river/ waterway before conventional drinking water treatment and delivery to the customers and end users

Approach to Water Recycling Globally

Singapore's NEWater

Singapore's NEWater is a product of the basic principle of collecting every drop of used water and further reusing every drop more than once. Singapore has developed an **IDWR and NDWR** program using NEWater. The treated used water from the WWTP undergoes MF/ UF treatment followed by RO and UV disinfection to produce NEWater. The product water quality is considered better than the drinking water standards.

NEWater has the following uses:

- **Indirect Drinking Water Reuse** – Used for reservoir recharge and further reused for drinking
- **Non-Drinking Water Reuse** – Used in industries for wafer fabrication, power stations, air-con cooling and landscaping

Arid Israel Recycled Wastewater on Grand Scale

Israel faced a daunting choice of finding a new water source or stopping production. Their solution was wastewater recycling, at a time, when no one had heard of the concept. Israel did not have enough water for agriculture and the country needed to adapt and implement an unlikely solution. Recycling used water has helped free Israel from depending on rain. Israel has developed a NDWR program wherein more than 85% of the domestic used water is treated and reused for agriculture and irrigation.

For a country like India, it is difficult to engage the public directly on the subject of drinking water reuse due to lack of public awareness, faith in urban water utilities and acceptance of the practice. A scheme for short, mid

and long term plan for India to move towards water resiliency is proposed in the figure below.



Project Drivers and Constraints

Water recycling projects require well considered, disciplined and comprehensive technical and financial planning.

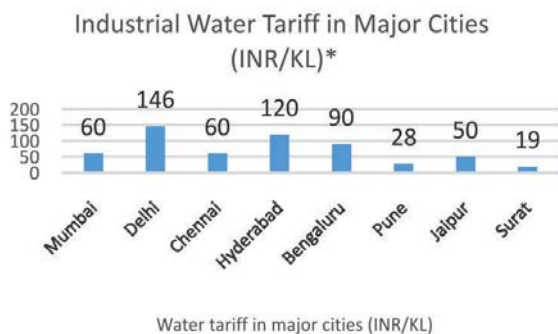
The following criteria could be used to help decide the most suitable format for water reuse. Whilst, these may be some of the most critical factors, a successful water reuse program is not limited to these factors. Additional factors could apply on a case to case basis:

- **Water Demand/ Supply Gaps** – This is important to justify the type of water reuse program to implement. A gap or shortfall in water supply to water demand can help to justify the need for an alternative water source such as recycled water.
- **Water Quality Data** – Detailed characteristics of the source and product water quality are critical factors. Presently product water quality of treated used water from STPs and/ or CETPs is aimed at only meeting the discharge standards. This needs a paradigm shift from just meeting regulations to achieving better quality standards with focus on TDS levels less than 500 ppm and extensive removal of microorganism and heavy metals.
- **End Use of Recycled Water** – It is important to know what the recycled water is proposed to be used for. The end use of the recycled water and the fitness for purpose help with deciding the degree and complexity of treatment technology required to achieve a water quality that suits the intended use.
- **Power Requirement and Cost (CAPEX, OPEX and LCC)** – This is a financial planning constraint. The primary objective of any utility or industry is to minimise the power requirement, utilise the CAPEX in an optimum manner and have a lower O&M running cost.

- **Funds Available and Willingness to Pay** – From a capital cost perspective, water recycling comes at a cost, since new infrastructure is needed, the cost of which is typically more than that for any other traditional or conventional water source such as groundwater or surface water. Rationally, the lowest cost of the next alternative water source should be selected.
- **Infrastructure Availability** – This poses a technical and institutional constraint. Infrastructure availability is not limited to land requirement but also encompasses the governance arrangement, compliances and policies.
- **Public Acceptance** – This is a social aspect and especially applicable if the water is used for municipal end uses and/or human consumption. This is the key to any successful water recycling project.
- **Recycled Water Policy, Codes and Standards** – There are numerous national level policies that advocate the need for water recycling to help meet the water demands of ever growing Indian cities. For instance, the “Handbook on Service Level Benchmarking” by MoUD specifies the degree of recycling and reuse to be at least 20% to begin with. This, however, seems a distant reality for most utilities in India since there are no uniform standards or codes governing water quality standards. Due to an absence of applicable Indian standards for water recycling, a composite of global recycled water quality standards/ guidelines could be adopted

Implementation – Water Recycling Projects for Industries

For any reuse projects to be viable, the treated used water



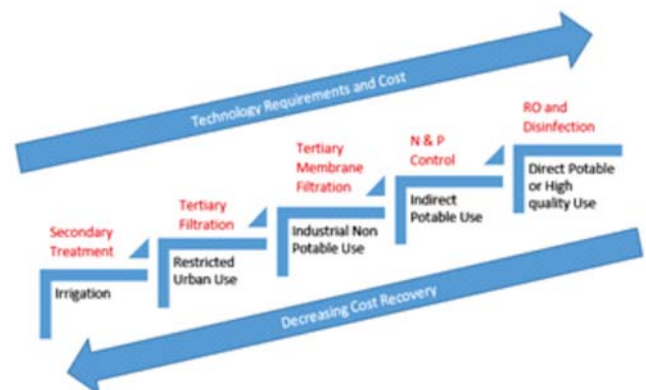
* Volumetric Charge for monthly consumption above 100 KL

should be cost-competitive when compared to alternative options available to industries. The conventional sources of water for industries include municipal water supply, private tankers, and direct extraction from freshwater sources. The least cost option is direct groundwater extraction which is regulated in most cities. Thus, the most reliable option for industries is municipal water supplied by utilities.

The industrial water tariff in most metropolitan cities and industrial towns ranges from INR 19 per kilolitre (KL) to INR 146 per KL. The weighted average of industrial water tariff is approximately INR 45 per KL. Given the price range for water from alternative sources, treated water at the end user point has to be appropriately priced in order to be competitive for industries to consider it an attractive alternative.

Reuse projects must study the market demand profile and choose a specific grade of water that will provide maximum financial returns. Higher the quality of water desired, higher will be the cost of the treatment and lower will be the cost of recovery, hence there needs to be balance between the treatment provided versus the cost recovery. It is important to assess the industrial profile and the quality of water demand at a location before designing the wastewater reuse plants. Water of higher quality should not be used for application that can tolerate inferior quality. There are multiple treatment technologies available and an appropriate one can be selected based on the various constraints identified above and any other limiting factors as identified by the relevant stakeholders.

Market demand is a key determinant for choosing treatment level and technology. CPCL is one such example, where water scarcity forced CPCL to scale



down its operations and begin thinking about reducing wastage. This led it to implement the first ever Zero Liquid Discharge (ZLD), wherein the municipal raw used water and the product treated used water was reused more than once, that would otherwise be discharged into a water body with no specific end use.

Industry Application Water Recycling Working Example in India

Chennai Petroleum Corporation Limited, Chennai (CPCL) is a leading example of water recycling with respect to magnitude and end use application. CPCL has 2.5 MGD (475 KL/hr) reclamation of raw wastewater (used water) through tertiary treatment and reverse osmosis. CPCL is executing an additional 2.5 MGD (475 KL/hr) city sewage reclamation plant as well as a 5.8 MGD seawater desalination plant. CPCL is the **first company in India** to go for a reverse osmosis rejects recovery plant of 80 KL/hr.

Upcoming Recycled Water Projects

Various initiatives have been taken for strengthening the water resiliency through recycle and reuse of the wastewater/ industrial water in many parts of India such as Delhi, Karnataka, Rajasthan, Maharashtra, Tamil Nadu, Gujarat, Andhra Pradesh and others. Secondary treated used water is purchased and treated for use in cooling water makeup in the industrial sector from as early as 1991 in major industries like Madras Refineries, Madras Fertilizers, GMR Vasavi Power plant in Chennai as also in Rashtriya Chemicals and Fertilizers in Maharashtra and most recently in the Indira Gandhi International Airport in Delhi and Mumbai International Airport⁵. Municipalities/ULBs of these states have now realized the requirement of developing an additional source of water through recycle of used water that may come from Sewage Treatment Plants (STPs) and/or Common Effluent Treatment Plants (CETPs).

A good example of water recycling in the industries comes from industrial estates in Maharashtra. A major agrarian state in western India with dependency on the monsoon rains, Maharashtra has faced acute water shortage and one of the longest droughts in recent years. The water supply scenario has been so grim that some parts of the

state are being supplied drinking water through railway train of water tankers. Consequently, industries have always faced water cuts with many industries experiencing water cuts of up to 40 percent of their regular supplies. This water shortage has impacted the industrial production in general and particularly the water intensive industries such as breweries, textiles, distilleries, pharmaceutical companies and high tech industries such as wafer fabrication and microelectronics.

Most of the industrial areas in Maharashtra have installed CETPs in their industrial estates, with their primary objective to comply with the surface water discharge standards. However, majority of the CETPs are not always able to perform to the required level due to reasons such as influent with significantly higher loads (BOD/COD) vis-à-vis design limits. In some cases obsolete technology and lack of properly skilled staff to manage the CETP operations are part of the issue. Considering this, the State Government has realized that there is a need to modify/ upgrade the current processes and capacities of the existing CETPs before they can be harnessed as a reliable source of water for the industry.

Several projects have been initiated by Government of Maharashtra for implementing the recycle and reuse concept in their existing industrial areas in order to develop sustainable and resilient water resources that will help to safeguard the industrial output, which has a direct bearing on employment and industrial revenue of the state. Under this, possible sources of water that are considered include municipal treated used water and industrial used water in addition to surface water. Looking beyond the statutory requirement to treat industrial effluent, the wastewater from industries, once properly treated, can be a reliable water source for the industries.

Similarly in Rajasthan, a proposal has been made for recycle of used water in Jaipur. The treated used water will be used for non-drinking domestic and industrial applications such as toilet-flushing, boiler water, horticulture, irrigation and landscaping. Government of Rajasthan is planning for a large scale NDWR project at one of the STP sites in Jaipur. It is planned to send recycled water to upcoming residential and industrial developments in the south east part of the city. An Advanced Recycled Water Treatment Plant (ARWTP) is proposed to treat

the treated used water from an existing STP operating on ASP technology.

An Indirect Drinking Water Reuse program has been proposed in Bangalore wherein treated used water from the existing STP is subjected to advanced treatment in a proposed new ARWTP. The recycled water is then proposed to be discharged in a reservoir upstream of the conventional drinking water source.

Conclusion and Way Forward

It can be concluded that water recycling is the need of the hour for the areas that are water stressed. It has also been observed that there is a lot of potential for water recycling in India.

There is a need to develop an integrated approach comprising a reliable and publicly accepted recycling plan that encompasses suggestive methods and best practices.

A wide variety of technologies are available and can be customised depending on the case to move towards an integrated and resilient water infrastructure.

Water recycling can also be incentivised by linking it with government benefit schemes (property tax subsidy, etc.) to encourage use of water recycling.

In addition guidelines for reuse of effluent water based on end use applications should be developed. Mandatory

norms/ regulations enforcing water recycling are required. Further, there is a need to enforce stringent policy guidelines for groundwater abstraction by industries. This can be achieved by strictly penalising unauthorised abstraction of groundwater as industries are a major consumer of recycled water. Additionally, the service level benchmarks by MOUD specify a 20% water reuse at present and these should be planned for a 40% reuse in the domestic sector, while the industrial cities should aspire for an 80% water reuse service level benchmark.

Water is the limiting factor for sustainable development and industrialisation. Right pricing for the right quality of water would lead to sustainable water reuse. Hence, recycled water is considered as an alternate source of water for industrial applications and water recycling for industries would be a good business decision in the long run.

(Footnotes)

¹ Ministry of Water Resources, Press Information Bureau (PIB), <http://pib.nic.in/newsite/erelease.aspx?relid=82676>

² National Water Policy (2012), Government of India, Ministry of Water Resources

³ Central Water Commission, Government of India

⁴ Performance Evaluation of Sewage Treatment Plants

Centre moves Bill for Single Tribunal On Inter-State Water Disputes

The bill proposes to streamline the adjudication of inter-state river water disputes and make the present legal and institutional architecture robust. There will be a single Standing Tribunal, which will be headed by a Chairperson with a five-year term.

Constructed Wetlands

An appropriate Technology for Wastewater Management aimed at Sustainable Development



Dr. Dinesh Kumar¹, and Dr. V. C. Goyal²

¹Senior Resource Person, Research Management and Outreach Division, National Institute of Hydrology, Roorkee. dinesh.poswal0197@gmail.com

²Scientist "G" and Head, Research Management and Outreach Division, National Institute of Hydrology, Roorkee. vcgoyal@yahoo.com

A class of eco-centric sewage treatment technologies that mimic interaction of soils and micro-organisms with pollutants as well as interaction of plants and other life in natural settings with pollutants in wastewaters are called as Natural Treatment Systems (NTSs). Among the several available NTSs, the Constructed Wetlands based systems for treatment of wastewater are being used across the world. Constructed wetlands treat biodegradable carbonaceous pollutants (BOD and COD), a host of pathogens, suspended loads of particulates as well as ammonia-nitrogen. In the light of shortages of water in several parts of the World (including in Asia), communities are searching for alternatives which would augment their water resources. In that context, clearly, the engineered constructed wetlands have attracted attention of environmental engineers and scientists by the virtue of their abilities of treating sewages and wastewaters at phenomenally low operation and maintenance (O&M) costs as well as low power requirements. Consequently, they have been favourably looked upon in the countries which have the natural advantage of tropical climate and warm weather.

The conventional mechanised sewage treatment systems, including activated sludge process, trickling filters and extended aeration systems, turn out to be rather expensive in terms of, both, the installation as well as operation and maintenance costs. The engineered variants of constructed wetlands have been investigated thoroughly at NIH, Roorkee for various types of communities including urban, peri-urban and small communities in the context of willing to own and operate their wastewater treatment systems. Interestingly, it was found that,

communities seem to favour the engineered constructed wetlands, owing to its capabilities of providing adequate treatment to wastewaters as well as generating adequate water for gardening/irrigation, cultivation of fodder and enhancement of agro-forests for generation of timber and biomass energy. Above all, the engineered constructed wetlands blend well with urban, peri-urban, and rural ecosystems. These systems can be effectively combined with advanced tertiary treatment alternatives and the resulting high quality treated effluents can be gainfully recycled into production and sanitation applications.

Wastewater treatment mechanism

During the passage, the wastewater comes in contact with a network of aerobic, anoxic and anaerobic zones. The roots and rhizomes leak oxygen in the packed bed reactor hence there remains an aerobic zone around them. On passing through the rhizosphere, the wastewater is cleaned due to microbial degradation and by physical and chemical processes. Organic compounds are degraded aerobically as well as anaerobically by bacteria attached to the plants roots, rhizomes and media surfaces. Oxygen required for this can be supplied directly by diffusion from the atmosphere or through the roots and rhizomes of the macrophytes. The settleable and suspended solids are initially removed in primary and secondary treatment by grit chamber and anaerobic reactors, respectively and wastewater containing dissolved organic matter treated in constructed wetlands unit. Nitrogen is removed in the constructed wetlands by nitrification and denitrification, volatilization, adsorption and plant uptake. Ammonia is oxidised to nitrate by nitrifying bacteria in aerobic zones,

and nitrates being converted to gaseous nitrogen by denitrifying bacteria in anoxic zone.

Advantages of Constructed Wetland Technology:

Constructed wetlands are cost effective and technically feasible approach for the treatment of wastewater and

runoff for several reasons such as - less expensive to build than other treatment options, operation and maintenance expenses (energy and supplies) are negligible. Operation and maintenance require only periodic labour rather than continuous labour (almost negligible). STPs based on constructed wetlands are able

Comparative Advantages of CW-based STP over Conventional STPs

Parameter	Constructed Wetland	Conventional STP
Area requirement	1.5 m ² is required per cubic meter of wastewater (open to sky).	---
Technology Cost	20 – 30% lesser capital cost as compared to conventional STPs	---
Operating Cost	Negligible	Substantial
Process operation	Self operating	Totally dependent on energy
Electricity / Energy Cost	Zero	Huge
Consumables, Chemicals	Zero	Substantial investment
Media Replacement cost	Only labour charge will be required for loading and unloading of media when system needs maintenance	Equipment cost is substantial
Type of land requirement	Landscape of any shape can be utilized for water treatment	Specific shape and dimensions important
Alteration in installed capacity	The Eco-technology can be constructed as per the demanded capacity of sewage treatment gradually and higher capacities can be added in later stages as well.	Not as good in retrofitting as constructed wetland-technology
Water Quality	Excellent	—
Pathogen removal	2 to 3 log reduction	1 to 2 log reduction
Nutrient removal	Along with carbonaceous polluting nutrients (N & P) also get removed	Not effectively removed
Micro-pollutants	Micro-pollutants, including, pharmaceuticals, bio-degradable toxic chemicals removed effectively	Not effectively removed
Compliance	Guaranteed compliance	---
Aesthetic	Looks like a garden	---
Odour	No odour	Odorous in case of power failure
Mosquito	No free water surface available for mosquito breeding	---
Manpower	Only sweeper-cum watchman if required	Trained manpower is required to make plant functional
Effect of temperature	No effect	Colder conditions affect the performance

to tolerate the fluctuations in flow. It can treat wastewater having low organic load (too low for conventional processes) and they also facilitate water reuse and recycle. In addition, they can be built to fit harmoniously into the landscape, and they provide numerous benefits in addition to the wastewater treatment such as aesthetic enhancement. They are an environmentally sensitive approach that is viewed in favour by the general public. Some of the key features of constructed wetland technology are:

- **Robust:** It is stable under load variations, insensitive to temporary limitation and provides consistent treatment results especially for sewages.
- **Efficient:** It does not generate solids and does not require solid (sludge) handling units.
- **Zero Energy:** It does not require any electricity to operate the STP, therefore, no environmental impact (negative green house impact).
- **Foot-print:** Space of any shape can be utilised and will look like an ornamental garden. The typical space requirement is 1.5 squaremeters per cubic meter of wastewater treatment.
- **Cost:** It requires 20-30% lower capital cost and zero O&M costs.
- **Flexible:** Existing STPs can also be upgraded easily with constructed wetland as a tertiary treatment facility to meet the desired compliance.
- **Trouble Free:** It has no O&M, and no recurring annual cost as compared to the conventional systems.
- **Expandable:** STPs being established on modular approach and can be commissioned at zero flow and can be expended according to the need.
- **Load Responsive:** Actively sloughed bio-film gradually responds to load fluctuations.

In summary, the constructed wetlands systems deliver a flexible, cost-effective means to address current wastewater requirements and the expandability to meet future loads or more stringent discharge requirements within a landscape design.

Success Stories

Several zero liquid discharge facilities have been implemented based on this invention for sustainable wastewater treatment and reuse. These facilities were implemented in various scenarios including urban, peri-urban as well as rural communities in fulfilling various needs. Systems have been designed and implemented not only to fulfill the regulatory guidelines but also to minimize overall water requirements. The collected wastewater is being treated upto an extent that the every drop of treated wastewater can be gainfully utilized. Some of the success stories implemented at Orient Residency, Jaipur and Rajneesh Hospital, a Multi-Specialty Hospital, Jaipur have been depicted below.

Orient Residency, Jaipur



View of building



Aerial view



View of the CW system

Rajneesh Hospital, a Multi-Specialty Hospital, Jaipur



View of hospital



View of the CW system



View of the CW system

Apex Multi-Specialty Hospital, Suratgarh, Rajasthan



View of hospital building



Site for the STP

50,000 liters per day.
Constructed Wetland followed by disinfection.
Gardening in building area as well as in associated area

Industrial Water and Sustainability



D V Saraiya

Industry Technical Director, Mott MacDonald Private Limited

1.0 Introduction

The very first thought that comes to our mind when we think of sustainability in industry is the conservation of water and electricity. Whereas limited availability of water of usable (potable) quality is an issue in the case of water, the challenge in case of electricity is the depletion of fossil fuel. In this article, we will look specifically at water.

Taken in an integrated manner, the water system in the plant should take care of following:

- Reduction in use as the first point of control,
- Recycle of used water within process with minor treatment viz filtration, pH adjustment,
- Effluent treatment with an aim to reduce environmental pollution where disposal outside factory premises is permitted, and
- Effluent treatment and recycle of treated effluent in the plant; a zero-liquid discharge (ZLD) concept.

We will look at available processes and industry practices for all the above situations, with special reference to the chemical and allied industries.

2.0 Reduction at point of use

Some of the factors and opportunities in this case are:

- a) Selecting the alternate processes requiring less water, depending on technological viability,
- b) Increasing recovery of usable quality low total dissolved solids (TDS) water from high TDS raw water e.g. RO recovery is typically 70% from a one-stage system, 85% from two stages and >90% from three,
- c) Heat exchange between various streams in chemical plants for heating or cooling applications instead of direct cooling by cooling or chilled water (CW/CHW). This reduces the load on the cooling tower, requiring less make-up water. For example, operating a multi-column distillation system at differential pressures gives the opportunity to use vapours from the penultimate column, instead of condensing with CW or CHW, as a heat source in the reboiler of the subsequent column,
- d) The use of adiabatic cooling towers instead of conventional ones reduces make up water by 40%,
- e) Use of air-cooled chillers instead of CW,
- f) Novel design of heating, ventilation, and air conditioning system. Spot cooling of areas and locations requiring low temperature comfort zones where a high occupancy of workforce is envisaged. A typical example of this is in tyre plants, where production areas in curing presses are very hot due to manufacturing operations at very high temperatures, which heats up work places, and
- g) Use of evaporative cooling with water curtains to reduce air temperatures, a popular household desert cooler concept, instead of refrigerated chilling plants.

3.0 Recycle of used water within process:

One of the simplest and easiest way to conserve water in plants is to recycle it in the same or different processes with or without minor treatment. Examples of these are:

- a) Water used for washing, such as in the cane and corn or paper and pulp industries as well as viscose staple fibre plants, can be recycled in the same process step by simply filtering out solid contaminants carried over into washwater.
- b) In specialty chemical manufacturing, one of the process steps invariably encountered in the majority of operations is the washing of the organic layer. Recycling second or third stage waters, which are expected to be the least contaminated in the first stage, can reduce net water usage.
- c) In many of the specialty chemical manufacturing processes, water formed in reaction is refluxed out during this stage to drive reaction in a forward direction. Water recovered at this stage can be used in subsequent washing stages, depending on requirements.

The segregation of effluent from various stages of process operations based on their characteristics, such as biological oxygen demand (BOD), chemical oxygen demand (COD), TDS levels or extreme pH conditions can help in effectively treating some of the streams by different methods.

4.0 Effluent treatment with an aim to reduce environmental pollution:

Wherever it is permitted to discharge treated effluent out of factory premises, Pollution Control Boards specify various parameters to which effluent must be treated. Major parameters on which effluent treatment processes are based are reduction of BOD, COD and TDS levels.

Some of the treatment processes widely employed to treat effluent to specified limits are:

- a) **Primary treatment**, consisting of:
 - Bar-screen filters to arrest large materials, such as plastic bags or paper, going to effluent treatment plant

- Oil and grease removal
- Equalisation with neutralisation, primarily mixing and pH adjustment
- Primary clarification to remove suspended solids

b) Secondary treatment/first stage aeration:

- Biological treatment stage one, which can be conventional aeration, membrane bio reactor (MBR), moving bed bio reactor (MBBR) or anaerobic
- Removal and recycle of active sludge with partial bleeding

c) Secondary treatment / second stage aeration:

- Biological treatment stage two, options similar to stage one

d) Tertiary treatment / polishing:

- Filtration thru multi-grade filters followed by:
- Chemical oxidation by chlorine, hypo, hydrogen peroxide or o-zone
- Trickling filter
- Adsorption of contaminants on activated carbon bed

e) Anaerobic treatment:

In some of the industries (e.g. alcohol distilleries, pulp and paper plants and food and beverages units) which feature high BOD or COD levels, it may be advisable to go for anaerobic treatment as the first step of the biological process, followed by other processes. This has the advantage over an aeration system as it consumes much less air and power, while at the same time generates biogas as a by-product which could be utilised as fuel in steam boilers.

5.0 Zero liquid discharge concept - effluent treatment and recycle of treated effluent in the plant:

Majority of approvals for new projects, specifically those in red or orange categories, specify ZLD from the plant,

meaning no liquid effluent can be discharged out of the plant premises, requiring additional treatment steps.

Some of the treatments steps to achieve this are:

- a) Reduction of TDS by using a multi-stage RO system, simultaneously concentrating small reject volumes.
- b) Multiple effect evaporation (MEE) for concentrating high TDS stream obtained from RO reject, followed by drying in Agitated Thin Film Dryer (ATFD)
- c) Solidliquid separation of concentrated mass by means of centrifuge or filters. Cake / solids are disposed of as hazardous waste to approved agencies.
- d) Polishing to reduce the levels of COD or BOD condensate collected from MEE, by biological or chemical processes or treatment with special condensate polishing resin.

e) Final treatment and recycle which includes the disinfection of recovered water by hypo or chlorination.

f) Pumping and recycle to plant in manufacturing process, or as make up water to cooling tower, land application or gardening, use as grey-water in toilets, etc.

6.0 Conclusion

There is no one size fits all solution for the use of water for industrial purposes. All the parameters and situations, as well as scenarios described in this article, go a long way in promoting sustainability in plant operations from an industrial water point of view. The guidelines and outlines given above would help an experienced design engineer to package a suitable scheme for the plant.

IIT-M's Low Cost Solution to make Brackish Water Potable

It may soon become possible to convert brackish water to potable water using capacitive deionisation (CDI) technology, at a cost of just 12 paise per litre. The process is cheaper than reverse osmosis and offers an affordable and sustainable solution to water scarcity. Reverse osmosis is energy intensive and causes 65-70 per cent of water to be rejected as waste, whereas in CDI, the wastage is only 25 per cent and it can work independent of the grid using solar energy. A prototype has been developed and tests are under way.



IDAX CONSULTING & RESEARCH PVT. LTD.

(AN ISO 9001:2015 CERTIFIED COMPANY)

CIVIL ENGINEERING CONSULTANCY & QUALITY CONTROL LABORATORY

Geotechnical / Soil Investigation

Quality Control & Quality Assurance (QC&QA)

- ✓ Soil & Rock Testing
- ✓ Building Construction Material Testing
- ✓ Bitumen Testing
- ✓ Non-destructive Testing (NDT)
- ✓ Mineral Testing

Survey

- ✓ Topographic Survey
- ✓ Hydrographic Survey
- ✓ DGPS Survey
- ✓ GIS
- ✓ Traffic Survey

Environmental

- ✓ Water Quality Analysis
- ✓ Air Quality Monitoring & Analysis

Services

- ✓ Design Consultancy
- ✓ Project Management Consultancy (PMC)
- ✓ Environmental Engineering & Protection
- ✓ Project Facilitation

Sectors

- ✓ Architecture, Structural & Town Planning
- ✓ Infrastructure & Telecommunication
- ✓ Highways, Railways & Bridges
- ✓ Power & Energy
- ✓ Chemical & Industrial
- ✓ Mining, Minerals and Metallurgical
- ✓ Construction
- ✓ Environmental Monitoring & Analysis



Plot No.- 5016, Duplex-E, Brundaban Enclave, VSS Nagar, Bhubaneswar- 751007
Mob: +91 - 9937061009, 7735599991, Ph: 0674 - 2581009, 2581001
e-mail: info@idaxconsulting.com, website: www.idaxconsulting.com

CEAI NEWS

SEMINAR ON “INDIAN CONTRACTS & RISKS – TIME TO RELOOK”

CEAI with the initiative of its Western Region Centre successfully conducted seminars on “*Indian Contracts & Risks – Time to Relook*” in Mumbai on 2nd December 2016 and in New Delhi on 3rd December 2016.

The seminar theme stemmed from the Prime Minister Narendra Modi address at the conference on the “*National Initiative Towards Strengthening Arbitration and Enforcement in India*”, organised by Niti Aayog in Oct 2016 where he emphasised that “A robust legal framework, backed by a vibrant arbitration culture is essential for India”. He also added that “We need a vibrant ecosystem for Arbitration, mediation and conciliation in India. Essential for ‘ease of doing business’” The Hon’ble Mr. Justice Tirath Singh Thakur, Chief Justice of India had remarked that “India needs an effective legal framework for speedy, affordable dispute resolution. This conference is a huge effort in that direction”

The speakers were senior and highly experienced practicing techno legal members were very well attended and the feedbacks are a testimony to the aptness and need of the topics discussed. They provided a platform to interact with the speakers as well as the large number of experienced professionals who attended and shared their experiences. The seminar thus provided an clarity and guidance to those working with different types of contracts for a better understanding of their administration and the handling of issues. The Case Studies presented were extremely insightful. Topics such as Risks and Financing whetted the appetite of the persons present and they desired detailed seminars on the same.

During the inaugural session, Mr. A P Mull, Past President CEAI accorded a warm welcome to all the dignitaries and participants. Mr. Sudhir Dhawan, President CEAI briefed them on CEAI, its activities and the need for legislation for engineers. Mr. Uttam Sengupta, Chairman CEAI-WRC briefed the participants about the seminar. Mr. Rajat Taimni,

Partner, Tuli & Co. welcomed the Chief Guest. In Mumbai Hon’ble Justice (Retd) S N Variyava, (Judge, Supreme Court of India), was the Chief Guest and he stressed on the importance of having clearly framed contracts. Mr. B Ravindranath, Head of Operations, Domestic Projects Group, Voltas Limited addressed the audience on the relevance and importance of all agencies including the Owners for working as a team and not go literally by the wordings in the contract but rather by its spirit to complete the project. The Vote of Thanks to the Chief Guest and Mr. B Ravindranath was proposed by Dr. H Subbarao, Vice President CEAI and Co-Chairman CEAI-WRC in Mumbai. In New Delhi, it was by Mr. L D Gupta, Director, CEAI. Mr. Jeffrey Nambiar, Hon, Secretary & Treasurer, CEAI-WRC, with his ubiquitous presence ensured that everything moved smoothly.

In New Delhi, the Chief Guest Hon’ble Justice (Retd) Mr. V N Khare, Former Chief Justice, Supreme Court of India, spoke on the need to make dispute resolution easier and faster in a time bound framework.

59 participants from around 32 different organisations comprising Consulting & Contracting firms, Government Departments, Public Sector Undertakings et al attended the seminar at Mumbai. New Delhi also was well attended with 52 participants from 29 organisations.

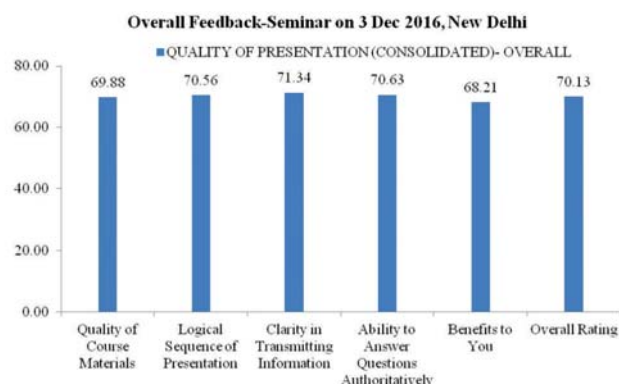
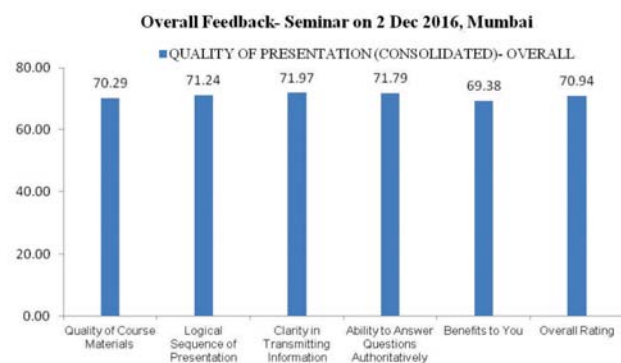
Mr. D G Diwate, Advisor, Mumbai Metro Rail Corporation Limited, was the Key Note Speaker in Mumbai. He narrated his experiences on various projects where the spirit was of cooperation for completion of the Project, keeping Quality, Cost and Time in mind. Team work by all agencies included the public – the land owners whose land was to be acquired in case of the Konkan Railway Project. They were made stake holders in the project.

Mr. S C Sharma, Former Director General (Roads) & Special Secretary, Ministry of Road Transport & Highways dealt on the Infrastructure in the country and the issues in contracts that need to be addressed.

There were 7 other sessions covering various facets of contracts, risks and project financing. as listed in the table below.

Speakers	Topics
Mr. D G Diwate, Advisor, Mumbai Metro Rail Corporation Limited/	Key Note: Experience on Infrastructure Contracts
Mr. S C Sharma, Former Director General (Roads) & Special Secretary, Ministry of Road Transport & Highways	
Mr. Paragbhai A Makwana, Former Chief General Manager, Exim Bank	Authoring a Contract and Contract Financing
Mr. Uttam Sengupta, Sr. General Manager, Contracts & Risk Management, Voltas Ltd.	Risks – the need for being explicit, efficacious and equitable FIDIC Contracts-A Comparative
Mr. Rajat X Taimni, Partner, Tuli & Co.	Recent Changes to Indian Arbitration and the Road Ahead for Construction Disputes
Prof. Dr. Kirity Dave, Techno-Legal Consultant, Mumbai/Mr. O P Goel, Former Director General (Works), Central Public Works Department, GOI	Case Studies: Awards given by Courts/ Arbitrators
Mr. Sumeet Kumar Maheshwari, Founder & Managing Partner, Udvik Infrastructure Advisors LLP	Contracts & Project Financing
Dr. (Adv) Milind S Wankhede, Legal Advisor, Construction Contracts and Arbitration Law	Contractual Provisions – Time for Completion & Delays – Safeguards, Obligations and Entitlements

All the sessions were very well appreciated by the participants and there was prolonged interaction after each. The consolidated feedbacks for both the seminars are shown in the charts.





L to R: M/s. D G Diwate, H Subbarao, Hon'ble Justice (Retd) S N Variyava, U Sengupta and A P Mull



Hon'ble Justice (Retd) S N Variyava addressing the gathering



L to R: M/s. S C Sharma, Sudhir Dhawan, Hon'ble Justice (Retd) V N Khare, A P Mull, Rajat Taimni, U Sengupta and J Nambiar



Hon'ble Justice (Retd) V N Khare delivering his address



Mr. D G Diwate sharing his 'Experiences on Infrastructure Projects'



Mr. A P Mull welcoming the Chief Guest, Speakers and Participants



Mr. S C Sharma dwelling on his 'Experiences on Infrastructure Projects'



Mr. Sudhir Dhawan talking about CEAI and Legislation for Engineers



Mr. Paragbhai A Makwana on 'Authoring a Contract and Contract Financing'





Mr. U Sengupta expounding on 'Risks - the need for being explicit, efficacious and equitable'



Mr. Rajat Taimni explaining 'Recent Changes to Indian Arbitration and the Road Ahead for Construction Disputes'



Prof. Dr. Kirty Dave enlightening with 'Case Studies: Awards given by Courts/ Arbitrators'



Mr. O P Goel citing 'Case Studies: Awards given by Courts/ Arbitrators'



Mr. S K Maheshwari on nuances of 'Contracts & Project Financing'



Dr. (Adv) M S Wankhede, explaining 'Contractual Provisions - Time for Completion & Delays - Safeguards, Obligations and Entitlements'



Mr. U Sengupta clarifying on 'FIDIC Contracts-A Comparative'



Dr. Subbarao giving the Vote of Thanks

FIDIC IN-HOUSE TRAINING COURSE

CEAI organised two-day FIDIC Training Course on “Understanding of FIDIC 1999 Conditions of Contracts for Construction, Plant & Design Build and MDB” for the employees (67 nos.) of M/s IRCON International Ltd, New Delhi on 22-23 December 2016.

Dr. Dhaval Parikh, Executive Director & COO of M/s SAI Consulting Engineers Pvt Ltd, was the Course Director and the trainer.

As per the option chosen by M/s IRCON, CEAI organised a FIDIC Training Course under the leadership of an Indian Faculty. The participants were from all level from Executive Trainees to General Manager. In all sixty Executives participated in the training programme.

The feedback of programme submitted by participants indicates that relevance of training, quality of course material, logical sequence of presentation & clarity of thoughts and ability to answer queries were rated as excellent. Some participants suggested that the duration to be increased to 3 days to include some case studies and practical exercise.

CEAI can organize similar training programmes for other organizations also.

SEMINAR ON “ASPECTS OF CONSULTING PROFESSION IN ARCHITECTURAL AND CIVIL ENGINEERING”

A one-day seminar was organised by Institution of Engineers India (IEI) and Consulting Engineers Association of India (CEAI) under the aegis of ARDB of IEI. The seminar was sponsored by CEG Ltd., Jaipur on 11th February 2017 at CEG Tower, Malviya Nagar Industrial area, Jaipur. The Chief Guest at the Seminar was Shri D B Gupta, Additional Chief Secretary,



Mr. D.B. Gupta, Chief Guest lighting the lamp

Government of Rajasthan. The seminar was presided over by Ms Sayona Philip, President CEAI. 64 participants attended the Seminar. Among the participants were Consultants of Rajasthan, Members and officials of IEI and Executives of CEAI.

Mr H K Mittal, Chairman ARDB, IEI, welcomed the Guests and Participants.

Mr. Vishwas Jain, Chairman-North Regional Centre of CEAI, in his address explained the purpose of the Seminar. He informed the participants that since long there have been issues raised by the architectural fraternity about the consultancy done by civil engineering consultants. This seminar was an effort to discuss the various issues involved and resolve them at the earliest possible.

Mr R P Gupta, former President, IEI, in his address apprised the audience that IEI is largest professional body, encompassing 15 engineering disciplines and gives engineers a global platform where the engineers can share their professional interest.

Mr. Sudhir Dhawan, former President of CEAI, gave a brief background about CEAI. He mentioned that CEAI



Dignitaries on Dais



Mr. Sudhir Dhawan, Past President CEAI addressing the audience

is the only member association in India represented at the International Federation of Consulting Engineers (FIDIC). He urged all the consultants present to become members of CEAI.

A presentation was given by Mr L D Gupta, Director CEAI, on the aims and objectives of the CEAI and the procedure to become a member of CEAI.

Mr. L D Gupta informed the gathering about various categories of membership. He explained the benefits of CEAI and urged all present to become the member of CEAI. He said CEAI is for YOU.

Ms Sayona Philip, President, CEAI, at the outset thanked Shri Vishwas Jain, MD, CEG Ltd., for taking the initiative to organise the seminar for the first time in northern region. She requested the participants to unite to strengthen the association for the welfare of its members. She further informed that CEAI has established linkages and plans to enhance cooperation with its counterparts in other Asian countries.



Ms S Philip, President CEAI addressing the gathering

Mr D B Gupta, Additional Chief Secretary, Govt of Rajasthan, spoke about the important role of civil engineers, particularly in the mega infrastructure projects in the country. He was of the view that a good consultant could deliver a project with quality, on time and utilising the expenditure optimally.

During the post lunch session, four technical papers were presented.

“Consultation Opportunities at What Cost”- Mr. Pramod Adlakha

Mr Adlakha shared his views that in past few decades consultancy was a profession but presently it is treated more as a business. Consultants use to quote around 10%

for consultancy but now to win the project, consultants quote as lower consultancy fees. He advised that consultants should not devalue their services.

“An Update for Requirements and Resources” - Mr. Sitaram Agarwal, Member, CEAI,

Mr. Sitaram Agarwal mentioned that Consultancy in Architectural and Civil Engineering are based on imagination and fact. The Architect and Engineer have to understand the Project requirements and meet the aspirations of the Client with updated requirements and resources.

“Consulting Profession and Approach for Fire and Life Safety in Health Care Buildings” - Mr. Yash Mittal, a young entrepreneur

Mr. Mittal presented detailed plan of a hospital building explaining how Fire safety in Health Care Buildings can be ensured by bifurcating the areas to discontinue the fire line and prevent spreading of the fire to the other parts of the building.

“Constructed Wetlands for Waste Water Treatment, A Sustainable Product” - Dr Dinesh Poswal

Dr Poswal described the technology as low cost, simple in operation, recycle and reuse oriented. A research station had been established at IIT Bombay, funded by the European Commission. He said that the technology had the potential to convert an ugly wastewater canal into a beautiful garden. The treated wastewater could be used for Irrigation and for rejuvenation of water bodies.

All present expressed that the Seminar was very useful for the Consulting fraternity.

CEAI NATIONAL AWARDS FOR YOUNG ENGINEERS 2016 – AWARD CEREMONY AND CELEBRATION OF WOMEN ENGINEERS DAY

CEAI designated the year 2016 as the *‘Young Engineers Year’* and instituted three categories of awards them.

- (i) Innovation in Design Engineering
- (ii) Innovation in Project Engineering
- (iii) Sherpa Award

A Jury headed by Dr Sudhir Krishna, Former Secretary, Ministry of Urban Development, Government of India, selected successful candidates for the awards. The

Awards ceremony was held on 17th February 2017 at Raunaq Hall of PHD Chamber of Commerce & Industry, New Delhi. The awardees were:

Innovation in Design Engineering



Mr Jigesh N Bhavsar of ICT received the award for Innovation in Design Engineering.
Innovation in Project Engineering



Ms. Vedika Agrawal of STEAG Energy Services (India) Pvt. Ltd. Sherpa Award



Mr. Manoj Kumar Murlidharan of Tata Consulting Engineers Ltd
(Award received by Mr Kanwar Singh due to his non arrival from South Africa)



Mr Jitendra Kumar Singh of Tata Consulting Engineers Ltd. receives Sherpa Award

The Awards were given to the winners by Chief Guest, Mr R K Mathur, Chief Information Commissioner and Former Secretary Ministry of Defence and Ministry of MSME. He is also an alumnus of IIT Kanpur. While handing over the silver shield and certificates to the winners, he complimented them for continuing their careers in hard core engineering instead of moving to other lucrative options. He also appreciated CEAI for taking such initiatives for the development of Young Engineers in India.

Before the award ceremony, a Panel Discussion was held on the topic 'Need to use advanced technologies/ tools in Engineering'.

Mr Sudhir Dhawan, Former President, CEAI moderated the Panel Discussion and Mr S C Mehrotra, Mr Abhishek Soni, Mr Swapnil Joshi and Mr Rahul Narayan presented their perspective on the topic.

Mr S C Mehrotra, MD, Mehro Consultants spoke on the use of latest technologies for Fast Track construction of Tall Buildings.

Mr Abhishek Soni, a bright young engineer from TCE delivered a talk on real time simulation of Construction with Integration of services for fast track delivery and better prediction of site errors.



Panel Discussion in progress on 'Need to use advanced technologies/ tools in Engineering'

Mr Rahul Narayan shared an exciting presentation of the process that his Team Indus underwent to build the first ever private spacecraft to the moon, gearing up for launch in Dec 2017!

Mr Swapnil Joshi, Founder Intento, shared his experiences in how effective project planning and monitoring, using tools like Primavera can save time, huge manhours and material costs.

At the outset, Ms Sayona Philip, President CEAI welcomed all the winners and participants to the Award Ceremony for Young Engineers.

Mr. Sudhir Dhawan explained about the concept and procedure of selection of awardees and the intention of CEAI for institution of the award to honour and to promote the talent of young engineers in India.



A view of the participants

Women Engineers Day

CEAI celebrates Women Engineers Day on 18th February every year. As a part of Women Engineers Day, Prof Geetam Tiwari, Professor of IIT Delhi delivered a talk on Transportation during the award ceremony in honour of Women Engineers.



Prof Geetam Tiwari delivering her talk

ANNUAL GENERAL MEETING

The 20th Annual General Meeting of the Members of the Consulting Engineers Association of India held on December 20, 2016 at CEAI Centre, New Delhi and passed the following:

- a) Confirmed the Minutes of the 19th Annual General Meeting held on 31st October 2015.



AGM is in progress

- b) Adopted the Annual Report of the Association for the year ended 31st March 2016.
- c) Passed the Audited Accounts of the Association for the year ended 31st March 2016.
- d) Appointed Auditors for the Financial Year 2016-2017.
- e) Approved the following Amendment to the Rules of the Association to create a *Past President's Council*

New Clause 4.1.4: Past President's Council

- To provide CEAI with continuing benefit from the experience of past Presidents, CEAI shall create a Presidents Council.

- The Presidents Council shall comprise allpast Presidents of CEAI/ACE/NACE.
- The Chairperson of the Presidents Council shall be the immediate Past President.
- The function of the Presidents Council shall be to provide advice to the Governing Council on matters referred to it by the Governing Council or to make suggestions to the Governing Council on important matters.

NEW PRESIDENT OF CEAI



The first meeting of the newly elected Governing Council was held on 20th December 2016 at the CEAI Centre.

During the meeting of the Governing Council, the members unanimously elected Ms. Sayona

Philip of Tata Consulting Engineers Ltd. as the President of CEAI for the tenure 2016-2018.

It was a proud moment for CEAI to have the first lady President in Ms.Sayona Philip.



The New President and other members of the Governing Council

CHAIRMAN EMERITUS OF CEAI

The Governing Council at its meeting held on August 26, 2016 decided to make Mr. Mahendra Raj as Chairman Emeritus of CEAI for his outstanding performance and life-long contribution to the engineering profession.

Mr Mahendra Raj will be a permanent member of the Governing Council in future.



Mr Sudhir Dhawan, President, presenting the Certificate to Mr. Mahendra Raj

During the AGM held on 20th December 2016, the members felicitated Mr Mahendra Raj and presented him with a Certificate.

NATIONAL FLAG AT CEAI CENTRE

CEAI installed in its premises the Indian National Flag on December 20, 2016. Mr. Mahendra Raj, Chairman Emeritus unfurled the flag followedby recitation of the National Anthem.



MAJ. GEN. HARKIRAT SINGH MEMORIAL AWARD

Maj Gen Harkirat Singh Memorial Scholarship has been instituted jointly by Mrs Harkirat Singh and the Association of Consulting Engineers (India) (now CEAI) in memory of Maj Gen Harkirat Singh, the dynamic past President of ACE(I), who did pioneering work in the development of engineering consultancy profession in India. The scholarship is awarded to the final year student of Civil Engineering at IIT, Delhi, who scores highest marks.

The Scholarship for the Session 2016-2017 was awarded to Mr. Rahul Pillania.

SEMINAR ON “PORTS AND INDUSTRIAL CORRIDORS”

The Ports & Industrial Corridors sector is one of the main drivers for the economy. Based on the Government of India's plans, it is envisaged that an investment of the order of USD 1.00 trillion would be made in the infrastructure sector.

The Consulting Engineers Association of India is, therefore, organising a Seminar on “*Ports & Industrial Corridors*” on **April 7, 2017** at India International Centre, New Delhi-110003.

The Sagarmala - Ministry of Shipping, Delhi Mumbai Industrial Corridor Development Corporation (DMICDC) and The World Association for Waterborne Transport Infrastructure (PIANC) are supporting partners for the event.

The seminar will HAVE Sessions related to Ports, Connectivity & Logistics and Port based SEZs, Industrial growth centres, etc.

Major players from the Government and the Private Sector have expressed their intent to participate in the Seminar to deliberate and share their experiences with various stakeholders.

Participation

Those who wish to present papers at the Seminar are requested to send an abstract of the paper in soft copy (in not more than 500 words), along with their profile and photographs at the earliest. It should deal with the Seminar theme. The selected authors will be required to submit the full text of their paper by 20th March 2017.

This is a unique opportunity to reach out to the key decision makers in Government and doyens of industry engaged in Ports & Industrial Corridors. We would, therefore, request you to kindly support this event and nominate delegates from your organisation for attending the same.

Sponsorship options and delegates registration forms are available on CEAI website www.ceai.org.in. They could also contact the CEAI Secretariat.

On this occasion, a Souvenir containing abstracts of papers, messages from dignitaries, advertisements and other useful information will be published. It will have wide circulation and distributed free of charge to the participants of the Seminar, Government Departments, PSUs etc. Organisations are invited to advertise in the souvenir to promote their respective organisations.

Tariff for the advertisement is as below:

Back Cover	Rs.25,000/-
Inside Back Cover	Rs.20,000/-
Inside Front Cover	Rs.20,000/-
Full Page	Rs.15,000/-
Half Page	Rs.10,000/-

Advertisement material (hard and soft copy) along with Cheque/DD favouring “Consulting Engineers Association of India” towards advertisement charges, should reach CEAI Secretariat before March 25, 2017.

FIDIC NEWS

FIDIC YOUNG PROFESSIONALS AWARD 2017

FIDIC has invited nominations for the 2017 FIDIC Young Professionals Award. This award is open to all Young Professionals aged 40 years and under and working for a FIDIC member firm.

The purpose of the Award is to acknowledge the remarkable achievements of YPs in our profession and to encourage their ongoing contribution to FIDIC and its Member Associations.

The nomination form and the instructions to the applicants have already been circulated to all members.

The nominations should submit to CEAI by May 1, 2017. CEAI will select an applicant and submit to FIDIC by June 15, 2017.

The FIDIC YP Jury's decision will be announced at the FIDIC International Infrastructure Conference in Jakarta in October 2017.

The winner will be provided a complimentary conference registration and attendance to the FIDIC International Infrastructure Conference in 2018.

OTHER NEWS, VIEWS & NOTES

47th Indian Valuers Congress'16 – A Report

Mr. Mainak Ghosal,
Consultant, Banking & Construction
Industry



Valuers' profession in India is at the crossroads with Demonetization; Company Act-2013; Real Estate Regulation Act (RERA); REITs; Benami Transactions (Prohibition) Amendment Act, 2016; SEBI Amendments; Income Tax Act; GST Bill & proposed Valuer's Act. In this scenario, the Institution of Valuers (IOV) organized their 47th Congress in Pondicherry from 28th -30th December, 2016 which had a footfall of 868 delegates mostly due to the fact that IOV had introduced "Active Professional Valuers List" in their website from 2017, which requires their members to attend at least two full day seminars in a year, to retain their names in the list. The Congress was inaugurated by Shri A. Namassivayam (Hon'ble Minister for PWD, Local Administration, Excise, Town & Country Planning, Animal Husbandry, Economics & Statistics & Stationery & Printing. Government of Puducherry) saw a MOU being signed by JAREA & IOV.



Hon'ble Minister Shri A. Namassivayam, along with the Japan Association for Real Estate Appraisers (JAREA) releasing the Souvenir at 47th Indian Valuers Congress'16.

The event had Valuer's role debated in the Banking sector NPA ('Never Pay Again?') and the proposed valuation

standards require that a standard valuation report should contain at least 1600 words with at least 50% value related words. It was also discussed that all Banks to have a Conflict Resolution Committee for an amicable solution after having a proper hearing from the concerned Valuer.

The impact of 8/11 Demonetization was deliberated to be painful in short term with both land and property prices crashing but in mid to long term it will be greatly benefit Indian Realty as it will create a lot of transparency with a strong likelihood of the bank lending rates coming down & EMIs being more affordable to a much larger segment of the earning class. With changing colours of money in market from 'Black' to 'Red', 'Grey', 'Green' or 'White', there would be possibility of more distress sales (Rs.15 lacs Rolex watch selling for Rs.15,000/- but Titan would continue to make profit with Bollywood's 'Dangal') during the next few months which cannot be a good indicator of a 'Fair Market Price'. It was also suggested that a shift from Indian Accounting Standards to International Accounting Standards may be effective for smoothening our Valuation Protocols. The lesson for the valuation industry is to wait and watch because there is likely to be a lot of confusion in the market for a few months before the market stabilizes. Therefore, the wisdom and the judgment of a valuation professional in India is more important today than ever before.

ICR- LIFETIME ACHIEVEMENT AWARD



Indian Cement Review (ICR) is the premier journal exclusively devoted to the Cement Industry.

ICR conferred upon Mr. Umesh Shrivastava, Executive Chairman, Holtec Consulting Pvt

Ltd, its prestigious "Life Time Achievement Award" in recognition of his sustained and valuable services to the cement industry.

The award was presented to him by Smt. Ravneet Kaur, Joint Secretary, Department of Industrial policy & Promotion, Ministry of Commerce & Industry, Govt. of

India, at a glittering ceremony at Nehru Centre, Mumbai on 9 December 2016.

IIID HRC HAFELE DESIGN AWARD 2016



The Hyderabad Regional Centre of the Institution of Indian Interior Designers (IIID) bestowed the 'Lifetime Achievement Award' on Dr B Ramagopal, Principal Consultant, NAVALE Consulting

Group, in recognition of his professional achievements, valuable contribution to the Interior Design fraternity and the supporting role in establishing the Chapter.

The award was presented to Dr Ramagopal at the annual awards function held on 21.10.2016 at Hyderabad.

Dr. B Ramagopal is an esteemed member of CEAI.

VISIONARY TALK

Mr. Amitabha Ghoshal, Chairman, CEAI – Eastern & North Eastern Region Centre, delivered a visionary talk during the 31st Indian Engineering Congress organized by the Institution of Engineers (India) held at Kolkata.



For this talk, IEI issued an appreciation letter for his informative talk and praised his august presence which inculcated a sense of pride amongst the engineers.

Homage to Dr. R N Vakil- by Mr Mahendra Raj

Passing away of Dr. R.N. Vakil is a great loss to the Profession of Engineering, the academia and the Nation.

Dr. Vakil, born on July 18, 1930, graduated from Vallabh Vidya Nagar Gujarat in 1953 as a Civil Engineer. After graduation, he went abroad to Wisconsin USA and acquired a Masters Degree in 1954. He continued his post-graduation studies to acquire a doctorate in 1957 from the same university in Wisconsin.

After acquiring doctorate, he moved to New York and joined a very well-known firm of Consulting Civil and Structural Engineers – Amman & Whitney (A&W), where he worked on very important assignments until 1959 and then returned back to India.

I first met Dr. Vakil when he joined A&W in 1957. I had joined that firm earlier in 1956. Dr. Vakil and I became very close friends while working for A&W. We had decided to start a consultancy firm together on our return to India.

In 1960 we started the firm in Mumbai as "Raj and Vakil (RV)". We were sharing a flat and working together. Somehow, we could not pull on together for a longtime and decided to work separately.

Dr. Vakil moved to Ahmadabad and I stayed back in Mumbai.



In Ahmadabad Dr. Vakil started teaching in the School of Architecture later known as Centre for Environmental Planning and Technology (CEPT) and formed a partnership consultancy firm of Vakil, Mehta, Parikh & Seth (VMPS).

Later Parikh formed a separate firm, but Vakil, Mehta & Seth stayed together and operated as VMS Consultants.

Dr. Vakil flourished in the field of education and in the profession and kept working in both the fields till the end.

In education, he became the Dean & then the Director of CEPT, and started educational facilities in many other disciplines. He was also attached to a number of other educational institutions as advisor or as a member of their administrative board.

In his profession, apart from his professional work, he was very active in various engineering associations. He was the founding member of the Indian Association of

Structural Engineers (IAStructE). He was Chairman or a member of various educational and professional committees setup by the Government and other authorities. He worked constantly for the benefit of the profession and contributed time and energy to various important issues.

Dr. Vakil was a very dedicated and warm person. Whatever issues he undertook to work for, he did so with utter honesty and dedication. His contribution to all these issues was self less, without expecting any returns. Dr. Vakil was a man of very simple habits and his philosophy of life was to benefit his fellow human being, in whatever

way he could. He succeeded very well in implementing this philosophy throughout his life.

He leaves behind his wife Mita, his two sons Rahul and Madhav, and a very large number of friends, admires and students who all learnt a lot from the example of his self-less and dedicated work in the field of education and the profession of engineering. He was a unique person, in all respects, and it will be difficult to find one like him for times to come.

We all pray for peace to the departed soul and strength to his family and friends to bear this unbearable loss.

VIEW POINT

The next issue of the View Point will be published in June 2017. The **June 2017** issue will be dedicated to **Transportation**.

Considering the vast experience amongst members in the sector, we would be happy to receive articles on the above theme to share their experience on the challenging projects engineered & constructed. Photographs may be added in the articles for better appreciation of the issues encountered and addressed. The articles for the June 2017 issue of VIEWPOINT need to reach CEAI by **30th May 2017**. Articles to be in Times New Roman 12 with single line spacing.

ADVERTISEMENT IN VIEW POINT

VIEW POINT is circulated to all CEAI Members, Government Offices, Public & Private Sector Undertakings, Construction Firms, Contractors, Consultants, Foreign missions and Funding Institutions in India and others organisations related to or dealing with the engineering profession.

In order to encourage members and others, CEAI offers attractive advertisement tariffs.

The advertisement tariffs per issue are given below:

ADVERTISEMENT TARIFF

Rate:	Back Cover	-	Rs. 20,000/-
	Inside Front Cover	-	Rs. 10,000/-
	Inside Back Cover	-	Rs. 10,000/-
	Full Page	-	Rs. 7,500/-
	Service Tax @15% extra / as applicable		

**In case the advertisement is to be inserted in consecutive four or more issues of View Point, a rebate of 20% will be admissible.*



Injection Technologies

Innovation in Building Chemicals

Drawing on its knowledge of international projects, MC has decades of experience when it comes to developing innovative systems for the protection and restoration of buildings. Whether you wish to restore or enhance the structural integrity or seal cracks and surfaces against the ingress of water, MC can offer the appropriate systems and materials. In addition, MC provides a competent consultancy and advisory service at all project stages.



MC-Bauchemie – Solutions built on innovation.

Murasit Bauchemie Pvt. Ltd.
Plot No 147/B, Kundaim Industrial Estate, Kundaim, Goa 403115
Phone: +919764443292 / 97 Telefax: +91(0832)2395700
murasit.bauchemie@mc-bauchemie.com www.mc-bauchemie.com

Flexible waterproofing and lasting repair

Innovative hydro-structural resins

Permanent elasticity

Highly elastic and permanently proof



TECH QUIZ¹

1. The following method(s) is/are most effectively used to remove high iron content from a well water supply:
 - (a). Feed acetic acid
 - (b). Retain until it settles out
 - (c). Oxidation followed by filtration
 - (d). Reverse osmosis
2. The letters or units “SCFH” appearing in ozonation literature mean:
 - (a). Slow cooling from heat
 - (b). Standard cubic feet per hour
 - (c). Stable cubic feet per hour
 - (d). Safe chemical for handling
3. Which of the following is/are known as low pressure membrane system in Membrane filtration technology?
 - (a). Microfiltration
 - (b). Nanofiltration
 - (c). Ultrafiltration
 - (d). Reverse Osmosis
4. Terminology used for generating energy equivalent to the amount of energy utilised by any treatment plant is:
 - (a). Zero Net Energy (ZNE)
 - (b). Net-Zero Energy Building(NZEB)
 - (c). Net Zero Building
 - (d). All of the above
5. Which of the following describe the quantity, timing, and quality of water flows required to sustain freshwater, estuarine ecosystems and the human livelihoods.
 - (a). Environmental Flows
 - (b). Ecological Flows
 - (c). Balance Flows
 - (d). Fresh Flows

The first 3 persons who mail the correct answers to CEAI will get a congratulatory mail and will be acknowledged in the next issue.

¹contributed by JK Singh, TCE



Consulting Engineers Association of India
(Indian Member Association of FIDIC)

CEAI Centre, OCF Plot No 2, Pocket 9, Sector B, Vasant Kunj, New Delhi 110070
Tel: 91-11-26134644 Telefax: 26139658
Email: info@ceai.org.in, ceai.ceai@gmail.com; Website: www.ceai.org.in