



Government of India



DECEMBER
5-7, 2019
VIGYAN BHAWAN
NEW DELHI
INDIA

Fourth India Water Impact Summit (IWIS)

Valuing Water | Transforming Ganga



cGanga

Centre for Ganga River Basin Management and Studies
Indian Institute of Technology Kanpur



NMCG

National Mission for Clean Ganga
Ministry of Jal Shakti, Government of India

A CONSOLIDATED REPORT ON
FOURTH
INDIA WATER IMPACT SUMMIT
(IWIS)

5-7th
DECEMBER
2019

VIGYAN BHAWAN, NEW DELHI



MESSAGE



RAM NATH KOVIND



सत्यमेव जयते

राष्ट्रपति
भारत गणतंत्र

President
Republic of India

I am happy to learn that the National Mission for Clean Ganga and Centre for Ganga River Basin Management and Studies (cGanga) are organising the 4th India Water Impact Summit from 5-7 December, 2019 at Vigyan Bhawan, New Delhi.

Water is a critical natural resource for India, and river basins are its repository along with other resources. But not only is water limited in availability, its quality too has degraded over the decades in many places. It is the need of today to promote decentralized approach, with a prime focus on water conservation, source sustainability, storage and reuse, wherever possible. People also need to be sensitized about judicious use of water.

I appreciate that India Water Impact Summit will focus on Integrated Resource Management for comprehensive River Basin Management. This includes how our water and wastewater management infrastructure and policies should be oriented for River Ganga's revival to create healthy water environments and inclusive development. This will also have linkages with our smart city program and our objective to provide water to every home.

I wish the organisers and all those associated with the Summit every success in their quest to find meaningful pathways for a clean, healthy and water-secure India.

New Delhi
November 28th, 2019

(RAM NATH KOVIND)

MESSAGE



M VENKAI AH NAIDU



उपराष्ट्रपति
भारत गणतंत्र

Vice President
Republic of India

I am happy to know that “India Water Impact Summit — 2019” is being organized jointly by the National Mission for Clean Ganga (NMCG) and the Centre for Ganga River Basin Management and Studies (cGanga) for Indian and global experts, stakeholders and investors to brainstorm on India’s water management infrastructure and river basin management.

Water as a resource is crucial to India’s development in the 21st century. I believe that India has the capability to emerge as a global leader in water management. Even though we may be water-stressed in many places and suffer from floods and droughts, we have taken a bold lead in committing to provide all rural households with reliable water supply and to upgrade our urban water and wastewater management facilities through Smart City Projects. Simultaneously, we are committed to clean up and rejuvenate our national river — River Ganga — along with other rivers and water bodies.

It is heartening to know that IWIS-2019 will deliberate extensively on Integrated Water Resource Management in all its complexity. If the transformation of natural drains and demand management are significant aspects of water and wastewater management at city-levels, so is the focus on protecting water sources and waste management at village- levels. Such local improvements can together contribute to river basin-wide actions and policy measures to bring about a radical change in our environment and quality of life.

I am happy that IWIS-2019 will focus on synergizing science and policy making for Integrated Water Resource Management at various levels.

I extend my greetings and best wishes to the organizers and participants of “India Water Impact Summit — 2019” and wish the Summit all success.

New Delhi
November 27th, 2019

(M VENKAI AH NAIDU)

MESSAGE



NARENDRA MODI



प्रधान मंत्री
भारत सरकार

Prime Minister
Government of India

The joint organization of the 4th India Water Impact Summit – 2019 by National Mission for Clean Ganga (NMCG) and Centre for Ganga River Basin Management and Studies (cGanga) is an appropriately-timed initiative.

Water is a precious, life-giving natural resource. Our Country is rich in natural resources including water. However, water scarcity affects many parts of the country every year. The predicament that not even 10% of water received from the rains in the entire year is harvested, needs to be changed. It is time to act and conserve water for the present and future generations.

Our Government is firmly committed to ensure India’s water security. We are striving to make available adequate and safe drinking water to every household.

We need to transform water conservation into a community-based movement at the grassroot level. With the power of Janshakti, we can make even impossible possible and conserve every drop of water. Water conservation techniques have been practiced for centuries in our country. We now need to advance with a judicious blend of time-tested techniques and latest best practices.

The ‘4th India Water Impact Summit – 2019’ will provide an opportunity to the experts to utilize the scientific knowledge and help in integrating the inputs with policy-making in the water sector. I am sure that the ideas of various stakeholders will lead to the preparation of a time-bound roadmap and strategies.

May the deliberation at the Summit benefit from new lessons and experiences, and lead to an enhanced water security for the posterity.

I wish the deliberations at the 4th India Water Impact Summit all success.

New Delhi
December 2nd, 2019

(NARENDRA MODI)

MESSAGE



GAJENDRA SINGH SHEKHAWAT



सत्यमेव जयते
मंत्री
जल शक्ति
भारत सरकार

Minister

Jal Shakti
Government of India

I am very pleased to learn that the National Mission for Clean Ganga (NMCG) and the Centre for Ganga River Basin Management and Studies (cGanga) are jointly organizing the “India Water Impact Summit - 2019” in New Delhi for eminent experts, stakeholders and investors to deliberate on important issues of Integrated Water Resource Management in India. ‘Namami Gange’, an integrated Ganga Conservation Mission, launched by our government is bringing a comprehensive basin approach and developing a model for river rejuvenation in the country. We have also successfully implemented the massive sanitation program ‘Swachh Bharat Mission’ which was once considered an impossible task.

Now we have initiated an even more challenging task of upgrading our water management infrastructure to world standards in designated Smart Cities and of providing domestic water supply to all rural households by 2024 (Jal Jeevan Mission) to complement and strengthen the Swachh Bharat Mission. Given India’s limited water resources, financial constraints and large population, both tasks are enormous given the limited development that had taken place in earlier decades.

Against this background, it is heartening to know that IWIS-2019 will brainstorm over Integrated Water Resource Management in our Smart Cities and villages - in the Ganga River Basin and other basins of the country - by bringing together science and public policy for consistent results.

The focus on rejuvenating natural drains in cities and on waste management in the countryside are welcome features of the Summit as they will add to our knowledge in managing water resources holistically. I also look forward to IWIS highlighting new technology suited for water/ wastewater management in India and for evolving new ways to generate revenue for water resource and water infrastructure management.

I wholeheartedly wish the organisers of IWIS-2019 success in their endeavour to help create a clean, resilient and water-secure India and a rejuvenated River Ganga.

(GAJENDRA SINGH SHEKHAWAT)

MESSAGE



RAMESH POKHRIYAL 'NISHANK'



सत्यमेव जयते
मंत्री
मानव संसाधन विकास
भारत सरकार

Minister

Human Resource Development
Government of India

I am delighted to learn that the “4th India Water Impact Summit 2019 (IWIS-2019)” is being organised jointly by the National Mission for Clean Ganga (NMCG) and the Centre for Ganga River Basin Management and Studies (cGanga) for academic and field experts, stakeholders and investors. It is heartening to note that the Summit will discuss many critical and urgent issues concerning India’s Water Resource and Infrastructure Management in the backdrop of rejuvenating the Ganga and other rivers of the country. While India has a long history of comprehensively managing our rivers and water resources, we now also have emerging problems of water scarcity and poor quality as our country develops in rapid strides in the 21st century. Thus, we have new challenges of establishing Smart Cities and supplying potable water to all villagers while securing the environmental safety of our water resources. Exchange of ideas and dissemination of knowledge and experience are therefore essential to resolving our present and future difficulties. I am heartened that IWIS will focus on many of these issues, and I hope that the deliberations will go a long way in resolving national concerns about river Ganga and our resources.

I congratulate the organisers, the participants and wish IWIS-2019 every success in their laudable endeavour.

(RAMESH POKHRIYAL 'NISHANK')

Preface



VINOD TARE

Professor and Founding Head
Centre for Ganga River Basin Management
& Studies (cGanga),
Indian Institute of Technology Kanpur



**RAJIV RANJAN
MISHRA**

Director General, NMCG
Ministry of Jal Shakti

We sincerely thank all participants from India and abroad for making the Fourth India Water Impact Summit an all-round success. The Summit was notable, not only for a plethora of innovative ideas and critical insights into integrated water management and financing through a fusion of science and policy, but also for spirited discussions among a wide spectrum of participants cutting across academic disciplines and fields of experience from India and the World.

The first Summit, held in 2012, was an aggregate of many activities on India's water resource management of current and previous years. The Second Summit, held in 2017, attempted to establish a new multi-disciplinary multi-stakeholder forum to bring together policy makers at national and regional levels, technology & engineering firms, finance and investment representatives, and civil society members to brainstorm on pressing issues of India's water environment. The Third Summit, held in 2018, reviewed the many different efforts that had been undertaken by various Central and State agencies to help meet Namami Gange's goals of rejuvenation and conservation of India's National River Ganga (Ganges), focussing largely on the most critical Ganga Basin States of Bihar, Delhi, Uttarakhand, Uttar Pradesh, and West Bengal.

With the insights obtained from the previous Summits and various national and global developments

on water issues, the present Summit deliberated on major ongoing developments in the Indian water sector aimed at integrating Science and Policy for Integrated Water Resource Management, assessing and provisioning for Major Water Impacts in Urban and Rural Areas, and developing new and innovative financing mechanisms through the Water Finance Forum which was initiated in IWIS 2017.

Integrated water resource management has been a frequently used catchword in India for decades, ever since water shortages and deluges began to occur in unexpected places and ecological/ environmental crises came to the fore. In actual practice, though, progress towards managing water resources in an integrated manner has been tardy due to water resource policies being divorced from the science of water resources. Consequently, the many agencies engaged in the water sector have each focussed on its specific individual water targets without paying much attention to the compatibility of their activities with other aspects of holistic water resource management. The disparate handling of municipal wastewaters, stormwater drainage and water bodies in urban locales is a case in point. The present Summit reviewed the role of urban stormwater drains as a vital link in water resource management between Sewage Treatment Plants (STPs) and the receiving water bodies. In particular, the role of natural drains and wetlands (natural or constructed) in managing water resource quantity and quality were discussed in depth to delineate how natural treatment can help purify and

enhance water quality in various stages.

The present Summit also discussed key aspects of water management in Indian cities, especially with many cities readying to upgrade to smart cities. Water resource management is not a very cohesive activity in India, partly because of water being a State subject, but also because a holistic approach has not evolved due to water management not having become a truly knowledge-based practice. This shortcoming is evident even in urban water and wastewater management faced with grievous flood and drought events over the years. Some key issues of water management in Indian smart cities that were deliberated in this context are: how urban water resources can be comprehensively managed by integrating different surface and ground water sources; the pros and cons of 24x7 municipal water supplies; enhanced revenue generation from municipal water supplies and reducing losses in city water budgets; advantages and disadvantages of dual pipeline in multi-storey buildings; preparation of urban river management plans; and what measures are needed to deal with urban floods and droughts.

Rural water is generally even less well managed than urban water. Other than operating and maintaining irrigation water supplies and some hand pumps and community water supplies, government efforts in recent decades have only attempted to revive or preserve village water bodies without taking account of the temporal and spatial dynamics of rural water resources and anthropogenic impacts on them. However, with the current focus on rural sanitation and domestic water supplies, overhauling rural water management has acquired new urgency. Hence this topic was deliberated upon extensively in the present Summit. The major issues considered were: *integrated management of water bodies, drains and aquifers in rural settings, challenges in managing black and grey waters separately, experiences of rural water & sanitation managers on the national "open defecation free" initiative, managing animal wastes and human wastes for pollution-free water resources, and community engagement in the success of the Swachh Bharat (Clean India) Program.*

As in the previous years' Summits, the present Summit also showcased and discussed new

technologies and innovations in water and wastewater management and allied areas. Government agencies are often handicapped in selecting appropriate technologies among promising new innovations in the water sector. A definitive evaluation process for the innovativeness, technical soundness, applicability in Indian conditions, resource requirements (such as energy, chemicals and land footprint), and costs (Capex and Opex) is therefore essential. The technologies presented are to be subsequently evaluated under the ETV (Environmental Technology Verification) process by cGanga in India in the areas of Decentralized Wastewater Infrastructure, Integrated Bioremediation/ Phytoremediation Techniques, Wetlands and Conventional Sewage Treatment, Comprehensive Solid Wastes and Plastic Wastes Management, Resource Recovery from Wastes, Water Efficiencies, Advanced Data Generation and Management (including IoT and Remote Sensing), and AI and Data Analysis in the Water Sector.

To meet the huge financial resources of several lakh crore rupees (at least \$100bn) to restore National River Ganga to its former unpolluted state and to upgrade water infrastructure in urban and rural areas, the Summit hosted the Second Water Finance Forum to devise appropriate means of raising resources. Several new financing approaches and instruments were discussed to encourage global and local investors with appropriate governmental initiatives and measures. The Water Finance Forum specifically considered Blended Finance Approaches to overcome credit constraints for the water sector, Development of a Water Bond (Ganga Bond), and Innovative Credit Enhancement Instruments as well as fintech-based Instruments for the water sector.

In concluding, we wish to thank the Government of India and our strategic partners, lead discussants, speakers, sponsors, staff and volunteers who put in a lot of faith and hard work into making this Summit a success. With the remarkable achievements of IWIS-2019 for evidence-based knowledge inputs and the continuing support of our national and international partners and well-wishers, we look forward to steadfastly carry on our endeavor for comprehensive management of India's water resources and water infrastructure in future.



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PLENARY SESSIONS

Harnessing National and Global Expertise and Co-operation for Ganga's Revival





PLENARY SESSIONS

Harnessing National and Global Expertise and Co-operation for Ganga's Revival





MEET AND GREET





MEET AND GREET



A: Welcome, Vision of cGanga and NMCG on River Restoration and Conservation, and Delivering on Objectives of Jal Jeevan Mission

B: Understanding the River Ganga and Learning from the Laboratory of the River Ganga

The event started with a short prayer

“ॐ सह नावतु ।
सह नौ भुनक्तु ।
सह वीर्यं कर्वावहै ।
तेजस्वि नावधीतमस्तु मा विद्विषावहै ।
ॐ शान्तिः शान्तिः शान्तिः॥”

SK Ratho, DDG, NMCG



THIS is a series of events we began in 2012 with the first summit where we aggregated the efforts of all the stakeholders in river restoration activities in the country, which was followed by the second summit in 2017 where attempts were made to establish a multisectoral and multi stakeholders

group so that the efforts so far made on river Ganga could be consolidated in a single platform. In the second summit we also launched the water finance forum for looking at the finance angle which is continuing even today. In the third summit last year we reviewed the activities taken so far. And now this is



DAY 1:

Thursday; December 5, 2019
15:00 – 16:00 h, 16:00 – 17:00 h

VENUE:

Hall 5, Vigyan Bhawan,
New Delhi

CHIEF GUEST:

Rattan Lal Kataria
[Minister of State, Jal Shakti]

SPEAKERS ON DAIS:

SK Ratho [DDG, NMCG]
Vinod Tare [Head, cGanga, IITK]
Parameswaran Iyer [Secretary (DWS), Ministry of Jal Shakti]
UP Singh [Secretary (WR, RD & GR), Ministry of Jal Shakti]

OTHER SPEAKERS:

Amita Sharma [Former Additional Secretary, MHRD]
Martina Burkard [Head of Programmes-GIZ, Germany]

VOTE OF THANKS:

Sanmit Ahuja [Expert, cGanga, IITK]

the fourth summit this year where we would like to bring in integrated water management concepts on a river basin approach and at the same time we would also like to introduce financing aspects in the water sector. And, with the creation of the new ministry, this will give a fillip to the Namami Gange Programme. This three-day summit, bringing together science, technology and governance issues will be deliberated in the next two days, and there are five tracks in this summit which will deal on policy issues, finance issues, issues related to technology, and two aspects of governance, i.e. Rural and Urban, which are very critical for the states as well as for the central government. The inputs

from this three-day summit will go in to the Ganga Knowledge Centre and will be acted upon by the NMCG.

In the mean while we have also worked on Ganga Knowledge Front – we recently had a training programme for building domain expertise, which is one of the key elements of this issue because we find that there is acute shortage of domain experts in various aspect of Ganga Rejuvenation. We have tied up with IIFM Bhopal, TERI New Delhi and Water Academy Pune to commence online courses on various aspects of river rejuvenation so that we will be able to get sufficient domain experts in this field.

GANGA KNOWLEDGE

Front – A training programme for building domain expertise in various aspect of Ganga Rejuvenation

A: Welcome, Vision of cGanga and NMCG on River Restoration and Conservation, and Delivering on Objectives of Jal Jeevan Mission
B: Understanding the River Ganga and Learning from the Laboratory of the River Ganga

Vinod Tare, Professor & Founding Head - cGanga



GANGA as a river is a symbol for us – a symbol of all rivers or, in fact, of all water bodies. That is why when we started our work – and in our vision document also – we said that in the Gita, Lord Krishna described his various forms as:

पवनः पवतामस्मि रामः शस्त्रभृतामहम् ।
 झषाणां मकरम स्त्रोतसामस्मि जाह्नवी ।।

So when we talk about Ganga we mean all rivers. And when we talk about a river, it's not just a channel but it is a body, and body means its basin, and basin means all the water bodies are interconnected and we look at them together. And that

is why we talk about Integrated Water Resource Management.

We cannot restore our rivers unless until we think about restoring small rivers. Ganga is the tip of the pyramid and all small rivers and water bodies are at the base. We cannot construct an inverted pyramid. We have to reverse that and start from the base, so we need to start working on small rivers, rivers which are lower order rivers that are almost the starting rivers.

We have been advocating the concept of Urban River Management Plan. In the

urban sector we cannot manage our rivers unless and until we learn to manage the small drains, and we are talking about interlinking of rivers! Why not start with small efforts? Why not first connect all drains and water bodies and small rivers at the city level and town level, and connect them not only at surface but also sub-surface so that we ensure that good quality water flow in them all the time? We want to visualize that all our small lower-order rivers will at some time have fresh water aquatic life which is indigenous to those drains and have come back.

Financial and economic issues of rural centers are completely different from urban centers. How do we empower the

communities? Empowering community is not just related to having some rallies or courses or conferences. In a real sense how do they take the ownership of the water bodies in those villages in the rural settings? Only when they start thinking that, yes, we will manage our water bodies! This is what our Minister also says, that this has to become a *Jan Andolan*. It will become a *Jan Andolan* only when everybody starts thinking that the water body which is adjacent to my home, the drain which is flowing in front of my house is my responsibility, and at one time it was clean so why should I not make it clean again?

We have identified six major pillars which we will have to work on. Because whether



A: Welcome, Vision of cGanga and NMCG on River Restoration and Conservation, and Delivering on Objectives of Jal Jeevan Mission
B: Understanding the River Ganga and Learning from the Laboratory of the River Ganga



it is Jal Jeevan Mission or restoration and conservation of rivers, they are two faces of the same coin. If we restore and conserve rivers then we will be able to deliver Jal Jeevan Mission, or if you deliver the Jal Jeevan Mission then we will be able to make sure that our rivers and water bodies are neat and clean.

We are looking at this particular summit as a bridge between those who think that they have the knowledge and those who are responsible for implementing or executing in the ground. When we say knowledge, I don't mean that only IITs create knowledge; even a mason who is working, even a farmer who is farming, even a person who is involved in gardening, is also creating knowledge and that knowledge is the one we collect, collate and try to communicate.

Whether it is river restoration or delivering the Jal Jeevan Mission will necessarily involve a variety of interests, and there maybe apparent conflicts of interest. How we will resolve these conflicts is by understanding the issues and

communicating them to the people so that they come to the table with all kinds of information and will be ready to negotiate. These are the first three important steps – you understand, you communicate and then you start negotiating, and this has to be done at the local level. Once this starts, slowly conflicts will go away, and when conflicts go away then people will be in a position to implement and take ownership. Unfortunately, right now what we do in river restoration and conservation is that we go to the last step – we allocate some resources, we start planning and designing a project and then implement that project, and when we start doing that we see lots of conflicts.

Building STP is not a regret activity, it is a non-regret activity. But the issue is where to build STPs? What capacity to build? And how do we use the optimal distribution of the capacities of STPs, wetlands, natural river bodies and also the water treatment in a very integrated way and that is what we are going to discuss in this particular summit and we may have to change some of our practices that we have.

Whatever things we are going to do – to deliver clean rivers or rivers with fresh water aquatic life, or delivering on Jal Jeevan Mission to make sure that every household gets water – we also have to understand that every pipe that we provide to a house will also result in a Nali. Right now, we have issues with whatever nalis or nals we have, but if we have more water supplied through pipe that will lead to even more nalis and again we need to think about how we shall manage that.

We have kept a target of 24x7 water supply in towns. Is this a right kind of target? We started this concept with some arguments that if we give 24x7 water supply, we will save water because when people don't have reliable water supply all the time, they store water and when the next time water comes, they throw away. But I think that was an old thing, nobody nowadays does that kind of thing.

At some point of time we also started using treated wastewater directly for certain purposes, and one of the things

we said is that we will use water for flushing purposes. Then we introduced the dual pipe system in new buildings. But the experience, whether you talk about Bangalore, Jaipur or wherever, is very different.

How do we make sure that the communities take the initiatives? Whether in urban centers, whether it is a resident welfare association or in the villages with gram panchayats or village level organizations, they become capable enough to manage things. The central and state governments only serve as guidance, not take the ownership of that. The job of the central government is more or less to create understanding, make sure that everybody works in tandem and not randomly, so that the efforts are coordinated. And these are issues to be discussed with those who have been involved in or engaged in collating knowledge and those who are actually facing the realities on the ground. This particular summit I see as a bridge between the two.

JAL JEEVAN
Mission or Restoration and Conservation of Rivers, they are two faces of the same coin



A: Welcome, Vision of cGanga and NMCG on River Restoration and Conservation, and Delivering on Objectives of Jal Jeevan Mission
B: Understanding the River Ganga and Learning from the Laboratory of the River Ganga

UP Singh, Secretary (WR, RD & GR), Ministry of Jal Shakti



WE had the ministry called Ministry of Water Resources, River Development and Ganga Rejuvenation – earlier called Ministry of Water Resources, and thereafter in 2014 the subject of Ganga Rejuvenation and National Mission for Clean Ganga were taken away from the Ministry of Environment and Forest and brought to the Ministry of Water Resources. Thereafter, the Ministry of Water Resources, River Development and Ganga Rejuvenation and Ministry of Drinking Water and Sanitation have been made into one Ministry called Ministry of Jal Shakti with two department headed by two Secretaries. I would say this is only the first phase of integration. The idea is that water is being dealt at so many places, instead most issues of water should be dealt at one place.

Whenever we talk about Ganga, even though the word says Ganga Rejuvenation, but 90% time people talk about Ganga Cleaning. In my opinion River Rejuvenation or Ganga Rejuvenation is a much-much wider term than just saying Ganga cleaning.

Very rightly in the beginning it was envisaged that we have both the concepts – Nirmal Dhara and Aviral Dhara. We did not talk much about Aviral Dhara because lots of people also otherwise say the solution of pollution is dilution. But if you don't have water in the rivers – wether it's a small river tributary or a first order tributary, second or third order tributary or the main river – what is more important is basically availability of water in the river. And that is why when we talk of Ganga

Rejuvenation and talk of water conservation or any other aspect of water, it is not that these two are two different things, both are dependent up on each other.

The problem of Ganga Rejuvenation is more like the story of 7 blind man and the elephant – whichever part one touches one says elephant is like that. So, everybody looked at Ganga problem from one point of view whichever he understood is the most important, but Ganga Rejuvenation is a much larger thing.

One article says that Ganga is one of the 10 most polluted rivers in the world. For the last 3½ years I have been trying to find some information, some evidence, some criteria based on which we say that Ganga is the 10th most polluted river. I do not know if the best way to look at the water of a river is dissolved oxygen, but for bathing water quality DO should be not less than 5 mg/L and all our data shows that right from Gangotri to Bay of Bengal almost everywhere the DO is more than 5 mg/L. Our rivers carry lot of silt, so our rivers except in peak summers, would not look blue as some of the rivers in other parts of world look like.

Recently there was a 34-day rafting and kayaking expedition from Devprayag to Bay of Bengal. It was basically a public outreach activity. I traveled from Bijnor to Garhmukhteswar to Patna and then reached Munger, and rafted from Munger to Bhagalpur, and how many dolphins I saw between Munger and Bhagalpur would have gladdened someone's heart.

STPs in India were being constructed since long, but in many cases you construct but they do not function. Someone rightly said that we pay for construction, but we do not pay for performance. What we need to do is we need to pay for performance not for construction. And that's why today we have the concept of Hybrid Annuity Mode (HAM) and One City One Operator in Jal Jeevan Mission, the most crucial aspect is not basically having

the distribution network, not only having taps, pipes and storage tanks or whatever it may be, what is more important is the source sustainability.

All cities have a very large number of water bodies. Most of the villages also have a large number of water bodies. Now either those water bodies are encroached upon or used for dumping solid waste or liquid waste, so emphasis should shift from larger kind of structure to smaller kind of structure. I am happy to tell you that in Udham Singh Nagar district we have already rejuvenated and de-encroached more than 200 water bodies and they are planning for another 300.

In Bundelkhand you will find that most of tanks and wells are full of water because they have taken people back to those tanks and wells. The day I had visited that district, in the evening five ladies brought five diyas to each well, and that was basically taking the people back. Because unless we again start worshipping our traditional water bodies there would be a problem.

Jal Shakti Abhiyan was done for 3 months period, but in my opinion Jal Shakti Abhiyan kind of campaign on water has to continue, and there is no reason why we can avoid the kind of water war which is being talked about.



INTRODUCTION OF "Concept of Hybrid Annuity Mode (HAM)" and "One City One Operator" in "Jal Jeevan Mission" reduce the lacuna assessed from earlier projects

A: Welcome, Vision of cGanga and NMCG on River Restoration and Conservation, and Delivering on Objectives of Jal Jeevan Mission
B: Understanding the River Ganga and Learning from the Laboratory of the River Ganga

Amita Sharma, Former Additional Secretary, MHRD



I would like to share the idea of Ganga Shiksha Yatra which we have just started. The first Ganga Yatra was actually when King Bhagirath went to do penance and pray for the descent of Ganga, and he did that so that the water could wash the ashes of his ancestors and redeem them, but I will secure them for the future. So, water of Ganga should touch and seed the minds of the young people. I think knowledge has to penetrate and we have to start with school children.

The idea about understanding Ganga, and then through Ganga understanding

the larger value, developing sustainable pathways. In this Journey – moving from Shiksha to Sanskar and then to Sanskriti or I would like to say that from education to value and society – that's the holistic approach.

You cannot disconnect culture and knowledge and environment. The importance of natural resources and interdependence of man and nature imbibe values of coexistence.

As a young IAS officer, I had trekked to Gaumukh and for me that was my limit

of knowledge. And when I interact with Dr Tare he said, no it's not all Ganga from its mouth, and I have to learn this at the age of 65. It's too late to learn. So, you should be at the age of 6 when you should know that Ganga is a river basin having all life forms and biodiversity with anthropogenic twists in the river. We tried to elaborate this in our design technologies of creating animated narratives and interactive games, or like e-Ganga its education about Ganga in e-forms to cover the educational text with respect to environment.

Many forms of life bloom in the lap of the Ganga. The first forms of life occur

when energy and nutrients in the form of nitrogen and phosphorus combine at suitable temperatures and habitat. In Ganga, these are phytoplanktons and periphytons. These are consumed by Heterotrophs such as micro- and macro-invertebrates. The Ganga, does indeed, encompass a complex food web.

We are trying to use 3D animations and on that the student will be able to enter and emerge himself into an experience of interactive learning. There are lots of videos on the Ganga but to customize it to students so that they can navigate and make choices trigger actions.

**SHIKSHA TO
Sanskar and then to
Sanskriti and that
from education to
value and society –
is the holistic
approach**



A: Welcome, Vision of cGanga and NMCG on River Restoration and Conservation, and Delivering on Objectives of Jal Jeevan Mission
B: Understanding the River Ganga and Learning from the Laboratory of the River Ganga

Martina Burkard, Head of Programmes-GIZ



GIZ is working together with NMCG on various topics of Ganga Rejuvenation, on river basin management planning, water reuse, E-flows, pollution abatement but one of the topic that is very close to our heart is the public outreach for adults but also for children.

Right now, as we are sitting here, we have a group of 40 teachers from schools – altogether 120 teachers right now in Lucknow – for training from various schools in districts in the Ganga basin. We are training them to how to deliver

this kind of interactive training and classes at school.

One of the things we are working on is what I brought here, the draft title is Ganga Box. This is one thing we want to educate the children that in some way is also about educating the teachers because they are sometimes use to normal educational material they are using in schools. How do you make classes really interactive? How do you engage children in various project and topics in livelier ways? So, this is

something we have developed and that we are now training teachers and developing pool of teachers to rotate this training further.

Sometimes our children are a lot wiser than we are and so training/educating our children will also mean educating the parents, educating the neighbors, educating the villagers, educating the people in the cities and sometimes we all should listen bit more to our children what they are saying.

"GANGA BOX"
 educate not only the children but also the teachers

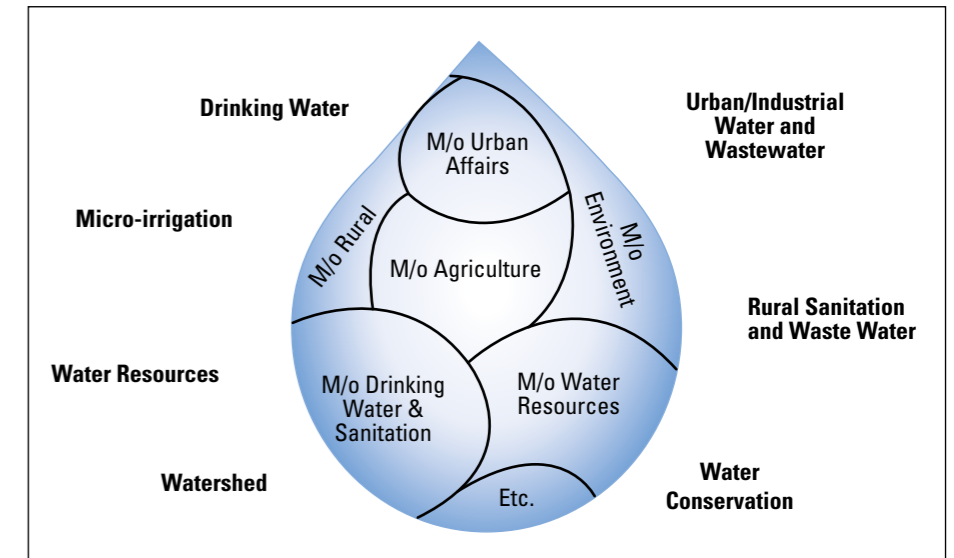


A: Welcome, Vision of cGanga and NMCG on River Restoration and Conservation, and Delivering on Objectives of Jal Jeevan Mission
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Parameswaran Iyer, Secretary (DWS), Ministry of Jal Shakti



Now water governance: After the Prime Minister created Jal Shakti Ministry, we have the Honorable Minister of state and both the Secretaries and now two departments in this ministry – the small Drinking Water and Sanitation and the much larger department of Water Resources, River Development and Ganga Rejuvenation. But It's important that this integration goes all the way down. At the state level we expect to have for the Jal Jeevan Mission, state mission, district mission and of course it will get integrated at the gram Panchayat and Paani Samiti level. This is in context of Jal Jeevan Mission, which is for rural drinking water. This



THIS government particularly in last five years has really focused on last mile delivery. Water was one missing basic services, at least in terms of providing tap water in every household. All the earlier services were provided in mission mode, so people actually got something which had not been there for many years after independence.

Some of the lessons we have learnt from Swachh Bharat Mission - Gramin for the water sector are the four big lessons we learnt from implementation of Swachh Bharat Mission which was basically making India Open Defecation

Free. There are Four 'Ps', first 'P' is Political Leadership so how do we link this with water. The second 'P' is Public Financing – in the Swachh Bharat Mission about 1 Lakh crores was committed for toilets incentives by the central and state governments. So that became very very important. The third 'P' is about Partnerships – with development partners, with gross root organizations, with NGOs, the private sector, media. And finally, the fourth 'P' is People's Participation, not a sarkari programme. Some of the lessons we have learnt from the Swachh Bharat Mission we hope we will also apply in the Jal Jeevan Mission.



A: Welcome, Vision of cGanga and NMCG on River Restoration and Conservation, and Delivering on Objectives of Jal Jeevan Mission
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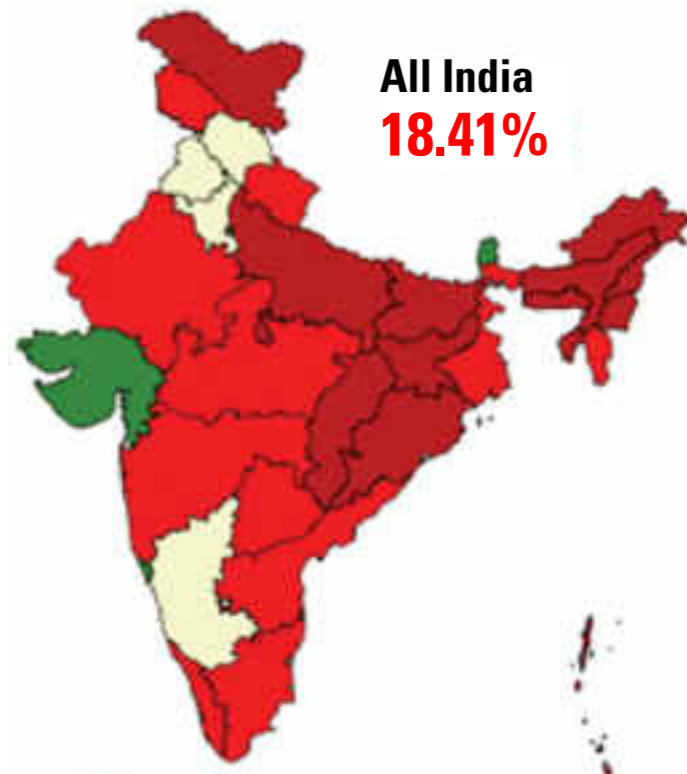
IN JAL SANCHAY

(water conservation) programme focus is on water conservation, source sustainability and reuse

is a five years programme, again looking at integrating water supply, ground water recharge, reuse and recharge, but focusing on providing a Functional Household Tap Connection (FHTC) to every rural household in five years.

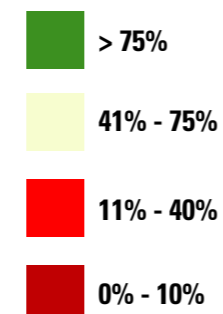
The Jal shakti Abhiyan, which technically ended on 30th November, will be scaled up very soon by the ministry and the department and taken across the country.

This was focusing on water conservation in 256 water stress districts based on data by the Central Ground Water Board. Based on the technology we focus on the five key interventions: rain water harvesting, renovation of traditional water bodies, reuse and recharge structures, watershed development and intensive afforestation. This programme is proposed to be scaled up nationally into a regular program and mainstreamed across the whole country.



RURAL WATER SUPPLY

Functional Household Tap Connections (FHTCs) (as on date)

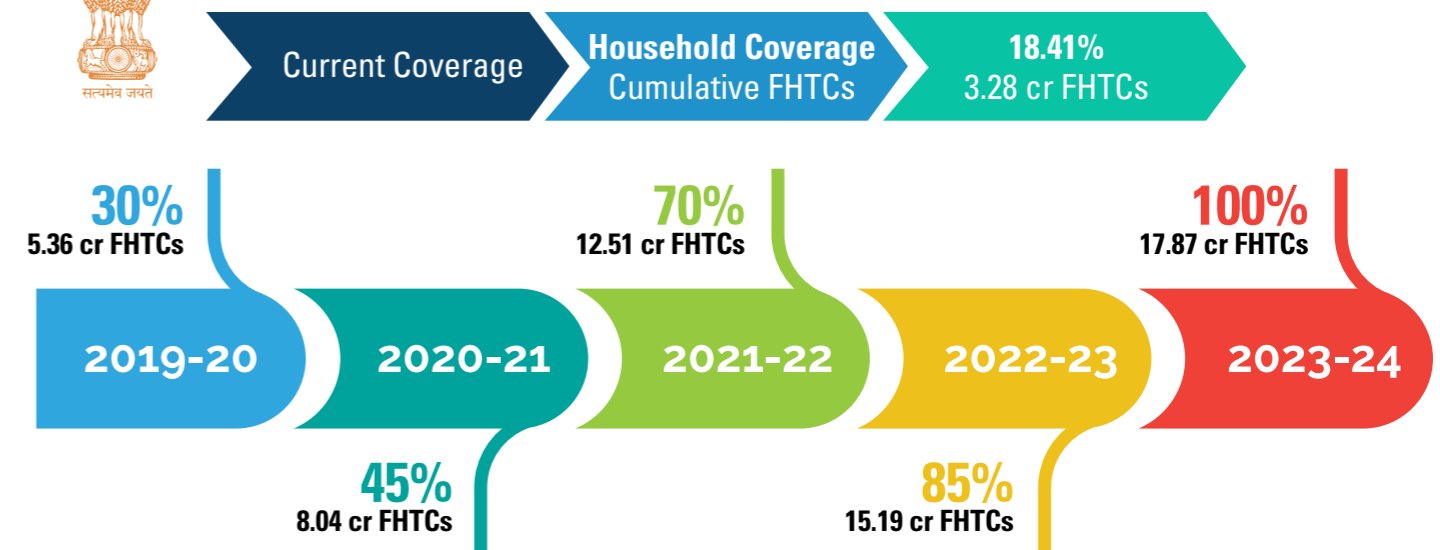


A bottom up approach for 18 crore Functional Household Tap Connections (FHTCs)

	Previous programmes	Jal Jeevan Mission
FUNCTIONALITY	Focus on Infrastructure	Focus on Quantity, Quality and Reliability
MONITORING	Departmental Reporting	Third Party Verification
IMPLEMENTATION MODEL	Mainly through PHEDs	At the Lowest Appropriate Level Creating a जन आंदोलन
जल संचय	Limited Focus	Mandatory <ul style="list-style-type: none"> ● Reuse of Grey Water ● Rainwater Harvesting ● Groundwater Recharge



JJM ROADMAP 2019 - 2024



Currently only 18% of rural households have access to tap connection at home. Now there are about 3.6 crore FHTC i.e. 18% and we need to do another 15 crores to achieve 100% and most of it is in big states of UP, Bihar, and MP.

Earlier the focus was on infrastructure creation, now the focus is on the functionality. Under the Jal Jeevan Mission the definition of FHTC is got to be adequate Quantity, Quality and Reliability,

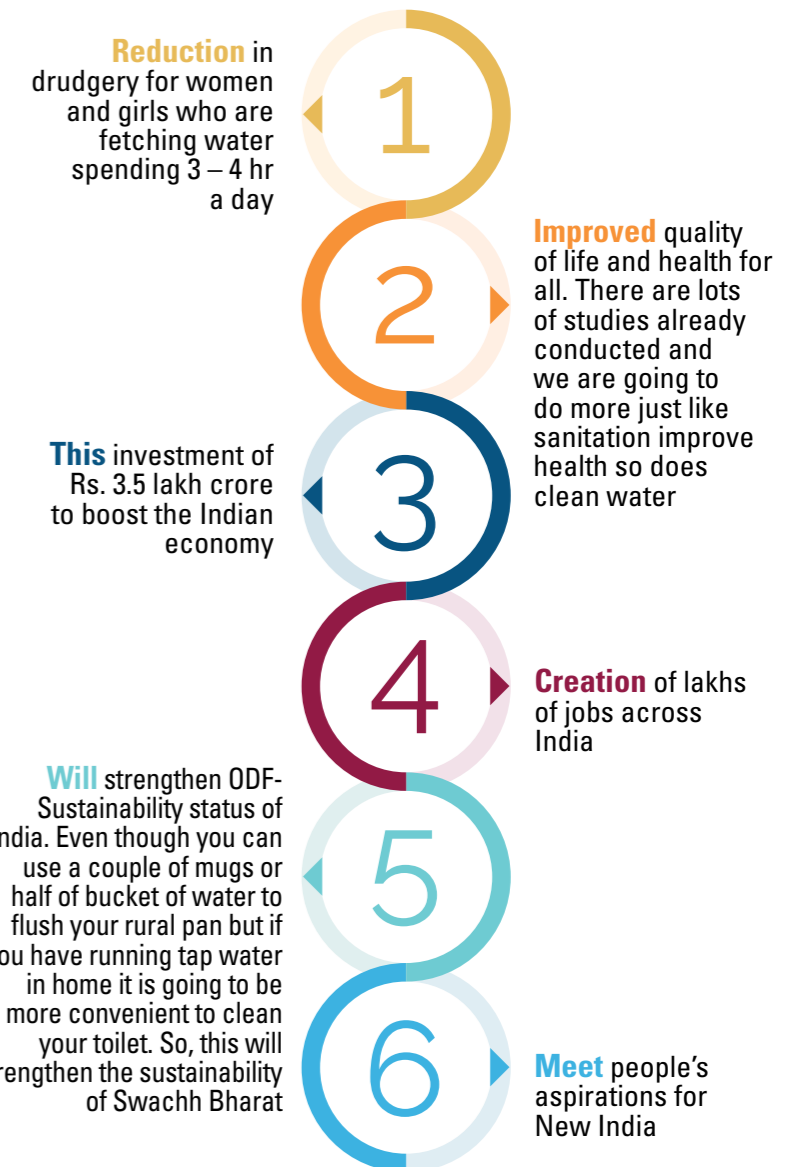
that will be measured through third party verification as against the earlier practice of departmental reporting.

The implementation model earlier was only through Public Health Engineering Departments (PHEDs) now it's gone to be at the lowest appropriate level which basically means if there is adequate ground water in a particular area then it could be a single village scheme that can be managed locally by the village water

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The Jal Jeevan Mission is not just about providing clean drinking water, but there are huge positive externalities from this programme



and sanitation committee. If there is no groundwater or there is quality problem and you got to bring water from outside from surface water, river, dams, reservoir etc. then it will be a higher formation, maybe it's PHEDs, it could be District Water and Sanitation Committee. So, there will be lowest appropriate levels whatever it is but we also want to create Jan Andolan, we want to get people involved, they need to own the scheme, they will need to fund the operation and maintenance within the village so that

the ownership and Jan Andolan is going to be fundamental.

Finally perhaps most important difference in Jal Sanchay (water conservation) and in earlier programme under drinking water there was very limited focus on water conservation, source sustainability and reuse. In this programme there are going to be mandatory three elements; ground water recharge wherever you are using groundwater, source sustainability, rainwater harvesting and the reuse of grey water.

**UNDER THE
Jal Jeevan Mission
the definition of FHTC
is got to be adequate
Quantity, Quality
and Reliability, that
will be measured
through third party
verification**

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Rattan Lal Kataria, Minister of State, Jal Shakti



AS a result of industrialization, urbanization, increase in population, change in group factor and other factors, the demand of water has increased manifold. Further, due to climate change, change in rainfall pattern and over exploitation of groundwater, the per capita availability of water in the country has gone down in last few decades. As a result we are heading towards water scarcity in the country. Friends, it is the right time to think and take concrete action for water conservation and proper management of water resources.

The Honorable Prime Minister in his first edition of “Man Ki Baat” program in the second term of the government has also raised the issue and emphasized on water conservation, water management and regeneration of water bodies. Our ministry has also launched Jal Shakti Abhiyan in 256 water scarce districts in all over the country in two phases in 2019.

Officers, scientist and groundwater experts from central government and state government work together for water conservation, rain water harvesting,

water courses and water bodies management, watershed development and intensive afforestation.

The Department of Drinking Water and Sanitation of Government of India has also launched Jal Jeevan Mission with the new vision of Har Ghar Jal to insure piped water supply to all rural households by the year 2024. For this ambitious goal, three-pronged interventions – sustainability of the water resources, recycle and reuse

of water – are priority agenda for our government.

The National Mission for Clean Ganga has been notified as an authority by carrying out diverse set of intervention for achieving the twin goals of Nirmalta and Aviralta of Ganga by ensuring effective abatement of pollution and maintaining required ecological flow.

NMCG has been taking up several innovative steps for bringing



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people closer to river Ganga and its tributaries which contributes in one way or the other for their conservation. On 4th November 2019 NMCG organized a river Ganga educational carnival "Ganga Utsav 2019", which was also a great success. Recently, a massive river rafting expedition called "Ganga Amantran Abhiyan" was launched from Devprayag on 10th October 2019. The expedition ended at Bakali Sea beach in West Bengal, downstream of Ganga Sagar on 12th November 2019. During the expedition, the expedition team interacted with the local masses spreading the message of how the environment of people play an important role in Ganga rejuvenation. Friends, during the expedition the member of the scientific team found that the health of the river has improved a lot.

This IWIS is one of special significance for India in order to evolve participatory method to rejuvenate and conserve

national river Ganga and other rivers in our country as well as to ensure long term water security for better water services for both urban and rural citizens in the near future. While the focus of the summit synchronizes with the goals set by our government for the water sector, it is inherently difficult because it is a pledge to combine the developmental need with our aesthetic, environmental and spiritual aspirations.

I congratulate NMCG and cGanga for organizing the summit to have fruitful discussions and deliberations among stakeholders, investors and subject experts for the purpose on hand. I thank all of you present here and wish and hope that at the end of the summit the subject experts will come out with new and innovative ideas for water conservations and better water management.

Thank you,
Jai Hind.

THE HONORABLE PRIME
 Minister in his first edition of "Man Ki Baat" program in the second term of the government has also raised the issue and emphasized on water conservation, water management and regeneration of water bodies

Release of RRC Manual, Report of Ambassadors' Meet, and Announcement of Knowledge Hubs



Inaugural Session

DAY 2:

Friday; December 6, 2019
10:00 – 11:00 h

VENUE:

Hall 6, Vigyan Bhawan,
New Delhi

CHIEF GUEST:

Gajendra Singh Shekhawat
[Minister, Jal Shakti]

SPEAKERS ON DAIS:

Vinod Tare [Head, cGanga, IITK]
UP Singh [Secretary (WR, RD & GR),
Ministry of Jal Shakti]
Rajiv Ranjan Mishra [DG, NMCG]

VOTE OF THANKS:

SK Ratho [DDG, NMCG]



Rajiv Ranjan Mishra, DG, NMCG

WHEN the Ganga River Basin Management Plan came, there were several components in it – some of the components are on the pollution front, some of the components are on the ecological front, some of the components are basically looking more in to the water use efficiency, and so many other issues. Likewise,

the way the current summit has been structured, we are looking at five different tracks and then after a Plenary perhaps the group would get into more detailed discussion of these tracks.

One of the tracks is science and policy for river rejuvenation for

integrated water management. I will request all the delegates to keep in mind that the purpose of all these deliberations on science and policy is for integrated water management or water finance or technology and innovation or water impact in smart cities. I mean this time we are looking very clearly on the urban system as well as the rural system in two tracks. Ultimately if you put all of them

together and go back to the place from where we had started by looking at the basin approach, all these tracks are going to fit into that.

We also have a point to start. We have lot of knowledge, we have lot of information, we have lot of expertise here, but ultimately the river basin management will have to be done in an iterative way, it has to be one in a cycle.

Vinod Tare, Professor & Founding Head - cGanga



WE view this summit as a bridge between the knowledge holders and those who are actually implementing or executing in the field. We have to have a very smooth flow of knowledge from the knowledge body into the implementation agencies and also the experiences of those who are executing and implementing back into the knowledge body. So we conceptualized this summit more as a dialogue than as a one-way presentation.

We started yesterday with how do we communicate whatever knowledge and experience that we have gained to our

next generation. We are beginning this journey – what we call as Ganga Shiksha Yatra. Whatever knowledge that we have been able to gather we have to give it to our next generation using modern tools like animations and internet of things, to communicate to the next generation what Ganga is and what are the issues of concern with water.

To me Ganga Restoration and Conservation and delivering on Jal Jeevan Mission are two sides of the same coin. How do we manage water in the rural scenario? it's easy to lay

pipelines and supply water through pipelines, but the most challenging thing is how the water will come into those pipelines? How do we ensure that the source of water both in terms of quantity and quality is ensured? And for that it has to be a mass movement.

River Ganga is not just one stream, it's not just five head streams that we talk about – it is thousands of streams which actually contribute to the body of Ganga and we'll have to take each and every part of the body to start with.

UP Singh, Secretary, WR, RD & GR, Ministry of Jal Shakti



रहिमन पानी राखिये, बिन पानी सब सूज़ ।
पानी गये न ऊबरे, मोती, मानुष, चूज़ ।।

THE Jal Jeevan Mission is a very ambitious programme about providing functional tap water to every household in the next five years. The SDG goals fixed the limit, I think, as 2030. We have fixed for ourselves a limit of 2024. And a lot of the people who didn't believe us earlier have turned into believers after the success of Swachh Bharat Mission. If the Swachh Bharat Mission could be achieved in five years then the Jal

Jeevan Mission can also be achieved in five years.

Monsoon is changing its face, which maybe an effect of climate change. But how to manage our water resources now? Our flood prone area or drought plane area has lost its meaning. Flood prone areas used to be located in UP, Bihar, West Bengal and Assam. Now you get floods in Vidarbha region of Maharashtra, Kutch region in Gujarat and Thar desert of Rajasthan which are known for their drought actually. So, we have to do a lot of adaptation in view of these climate changes.

THE FLOODS IN

Vidarbha region of Maharashtra, Kutch region in Gujarat and Thar desert of Rajasthan which are known for their drought are the consequences of massive climate changes

One thing which contributed very heavily to our enhanced water use was very large number of groundwater structures. But today groundwater structures which were a part of our solution has become a part of our problem. We all know that in states like Punjab and Haryana we are going to run short of groundwater maybe in next 10 to 15 years. So, how to deal with that kind of a situation?

As I told yesterday, now our challenge is not so much water resource development, our challenge is sustainable water resource management. So, let's all work towards the sustainable water resource management that is also linked to river rejuvenation.



cGanga Reports and Announcements



GANGA, a means of livelihood, a means of bread and butter. It is a civilization for us. Very rightly said, Sir.

May we request our Chief Guest, the Honorable Minister, to kindly first release a report on the Ambassadors' meet. cGanga and NMCG organized a dialogue of various Ambassadors and Honorable Minister Shri Gajendra Singh Shekhawat on 22nd August 2019 in New Delhi focused upon water security in India and the need for international cooperation for transformation in water sector through collaboration, particularly in the area of accelerating technology transfer and knowledge sharing. This report highlights the meeting's proceedings.

There's another release now – a report on River restoration and conservation which is a concise manual and guide. This manual attempts to describe in a concise manner the background, objectives, vision, knowledge framework, methodology, governance principles, restoration strategies, monitoring, feedback and correction mechanisms and financial management of the river restoration and conservation plan. This document is intended to act both as a guide for non-specialist reader as well as a broad instruction manual for special implementing agencies.

The third and the final release are documents

on cGanga hubs. cGanga knowledge hubs are focal points for developing new policy, economic, technical and financial ideas around specific themes. The knowledge hubs will be led by a consortium of national institutions who will champion the development of specific ideas. After much deliberation and needs' assessment from all stakeholders, cGanga established three knowledge hubs which are being announced today at the 2019 India Water Impact Summit. The three hubs are River Data and Information, Circular Economy, and Water Finance.

cGANGA KNOWLEDGE
hubs are focal points for developing new policy, economic, technical and financial ideas around specific themes



Gajendra Singh Shekhawat, Minister, Jal Shakti



AS per Census 2011, 377 million people are living in urban areas in India and by 2030 it is estimated that this number will grow to 600 million. This burdens our natural resources like water bodies and rivers tremendously.

There is an urgent need of having a robust and integrated approach for water management and improving efficiency in the demand and supply side of water to improve the water situation in India. Hence a dedicated ministry of Jal Shakti was set up by the Honorable Prime Minister Shri Narendra Modi Ji for holistic management of water resources and all aspects of water in country.

We launched the Namami Gange Mission earlier. Around 305 projects have been taken up, and these projects are not only for creating sewage treatment facilities but also to create facilities for treatment of industrial effluents and other polluting elements. The approach in Namami Gange for ensuring Aviral Dhara for improving flow is comprehensive and includes assessment and notification of environmental flows, catchment area treatment, afforestation, conservation and rejuvenation of wetlands, flood plain protection, spring rejuvenation and improving water use efficiency – particularly in agriculture.

Namami Gange Mission also understands the crucial role people can play in conservation of river Ganga and other water bodies, and has been taking up several innovative steps to bring people closer to River Ganga and its tributaries which contribute to their rejuvenation. I am delighted to see such a bright number of stakeholders participating in this mission. Recently, a massive river rafting expedition called Ganga Amantran Abhiyan, was launched from Dev Prayag on 10th October 2019. It was a 34 days programme which covered ~2500 km length of entire Ganga. People from Indian Institute of Toxicology

and Wildlife and Aquatic Life Sciences in this group observed that quality of water in River Ganga has improved tremendously in the last 4 years. I've been told, whereas five years ago they could see only a couple of tens of numbers of Gangetic Dolphins in the river, this time they observed more than 2000 Gangetic Dolphins and other aquatic life has improved. That is a sign that quality of water in the river is improving. There is also massive reduction in the floating trash and this is the fish eye view of river Ganga, and I am delighted to know about the improvement in water quality after taking Namami Gange in Mission mode.



I also want to mention about environmental flows and urban river management plan that emerged out of the Ganga River Basin Management Plan. Urban solid waste is another area which is abusing the rivers and flood plains throughout the world. The Government of India, vide notification dated 9th October 2018, notified minimum environmental flows to be maintained in river Ganga from its origin to Unnao in Uttar Pradesh. We recently also started a pilot project and developed an urban river management plan with NIUA. These are probably the two areas wherein there is a scope of experience sharing with global experts. We are working to have integrated water management wherein mainstream health of the rivers and water bodies should become important part of urban planning.

I'm happy to know that under the overall umbrella of Namami Gange Programme, cGanga will be exchanging technology collaborations, agreements with ten identified technology partners selected through environment technology verification process by cGanga. The focus of today's agreement is vast and fascinating. We have technologies in the field of Artificial intelligence, Containerized sewage treatment technologies, Plastic pollution management, Waste trading platforms, Bio-remediation and Aquaponics, Membrane based farming systems, Water tracking and management system, Distillery waste to biofuel, Advanced anaerobic digestion technologies, and UV water treatment, etc.

The Union Cabinet, chaired by Honorable Prime Minister Narendra Modi Ji has given



its approval for establishment of the Clean Ganga Fund. The Clean Ganga Fund will have the objective of contributing to the national effort of improving the cleanliness of the River Ganga with contributions received from the residents and non-residents of the country. The fund will define specific and measurable objectives to form the basis of planning funding and evaluation. I appeal to corporates, academicians, media houses and individuals to contribute generously towards the Clean Ganga Fund.

The cleaning of rivers including Ganga is a perpetual process and it will always require dedicated service of the people to maintain its healthy state. We should therefore aim for integrated water management, prevent degradation and pollution of rivers, lakes, and aquifers,

promote recycle and reuse of treated wastewater and where necessary restore and maintain acceptable environmental conditions of water quality.

Media plays a very important role towards success of a government programme. Any government programme, has four pillars to see the light of success. The most important thing is people's participation, and for that publicity is the crucial most. Hence, I request the media to help us in making the Ganga mission a Jan Ganga Mission, a public Ganga Mission and to make our country water secure in the coming future. I wish all the success to the deliberations for rest or rest of the day and to tomorrow and I want to congratulate National Mission for Clean Ganga and cGanga for organizing this event.

**THE CLEAN
Ganga Fund will
have the objective
of contributing to
the national effort
of improving the
cleanliness of the
River Ganga**

SK Ratho, DDG, NMCG



THE Honorable Vice President conveyed in his message for synergizing science and policy, and that's the theme we're having. We expect the huge participation, discussion and deliberations will give us more meaningful and useful ways to take it forward.

The Honorable Prime Minister in his message has called upon the power of Jan

Shakti, again the people's power to change the things around, and he has asked for a time bound road map and strategies. We are extremely thankful to Honorable Prime Minister for his blessings and message.

The Honorable Minister is steering this whole programme, and even today we are blessed by his presence and it strengthens us. We are extremely grateful to you Sir.





Global Cooperation for a Global Issue

A: EU-India Cooperation on Water

B: India's Collaboration on Water with other Nations

DAY 2:

Friday, December 6, 2019
11:30 – 13:00 h

VENUE:

Hall 6, Vigyan Bhawan,
New Delhi

CHAIR:

UP Singh [Secretary (WR, RD & GR),
Ministry of Jal Shakti]
Sanmit Ahuja [Expert, cGanga, IITK]

LEAD DISCUSSANTS:

P2A:

H.E. Ugo Astuto [Ambassador of
European Union to India]
H.E. Gyula Pethö [Ambassador of
Hungary to India]
H.E. Jasper Wieck [Deputy Chief of
Mission, German Embassy]
H.E. Marten van den Berg
[Ambassador of Dutch to India]
H.E. Marjan Cencen [Ambassador of
Slovenia to India]
H.E. Steen Malthe Hansen [Deputy
Chief of Mission, Denmark]

P2B:

H.E. Ron Malka [Israel Ambassador
to India]
H.E. Mike Oquaye Jnr [Ghana High
Commissioner to India]

SPECIAL REMARKS:

Jeno Labdy [Deputy Director, General
Directorate Water, Hungary]

WATER security is not just an Indian subject but a global one. In this modern age when almost all human beings have access to mobile phones, not having access to clean water is a sign of stark water poverty. The Ministry of Jal Shakti, Government of India is initiating a global call to action to invite nations from around the world to join forces in addressing to save the most precious resource on the planet.

In continuation of the tradition, the inaugural IWIS sessions invite international partners and senior diplomats based in India to share their insights, analysis and recommendations on how to deepen cooperation with India on the subject of water. The session in 2019 was divided in two parts:

- **EU-India cooperation on Water - represented by Germany, Netherlands, Denmark, Hungary, Slovenia and the EU Delegation to India.**

The representatives commented on the following points:

- A. The importance of collaboration on water between EU and India
- B. Prospects for the EU-India Water Partnership signed
- C. How can EU support in accelerating innovation in the water sector to India
- D. What role can EU play in making available long-term financing for the Ganga River programme and the larger water sector in India

- **India's collaboration on water with other nations – represented by Israel and Ghana**

The representatives commented on the following points:

- A. Importance of sharing learnings and efficient knowledge transfer
- B. Importance of down-streaming technologies and knowledge from India to Africa



Global Cooperation for a Global Issue

A: EU-India Cooperation on Water



UGO ASTUTO
Ambassador of European
Union to India



GYULA PETHO
Ambassador of Hungary
to India



JASPER WIECK
Deputy Chief of Mission,
German Embassy

Water is not just a resource, it's the flow of civilization. In both European and Indian philosophy you find a particular reference to water as an essential element for life. But leaving the philosophy aside, I think the management of water is an essential feature of public policy worldwide.

- Water is indeed an essential part of our partnership with India. We set up a water partnership in 2016. I think it has been extremely effective in terms of the fostering best practices and progressing together our best to protect water. It's a partnership that is multi-dimensional. And its nature brings together policymakers, government, experts, the business sector.

- Just to give you a few highlights of what we have done so far, and I would also like to quote the work which has been done on the Tapi River Basin Committee to develop the overrule of the Tapi river basin management plan. We also developed the first version of Environmental Flow Guidance which is typically important and it aims to ensure sufficient water in the Indian rivers, to protect the biodiversity. We have also taken steps towards the information systems for the Ganga.

- Research and innovation are key in finding the right solution for the management of water. We have several projects which have been funded and we have set up Indo-EU Project Consortium which have a particular importance related to best practices in EU and let me finally say what you see here is graphic evidence of this Water Partnership brings together all European Member states, each of them bringing the right volume and hopefully offering the best.

I'm representing the only landlocked country in this panel. But I would like to add to all of my colleague's speeches or comments one more thing that the water is no longer a local issue and therefore requires very strong and very close cooperation between the countries and also the regions.

- Hungary has a bilateral water agreement with India and this agreement expresses our willingness to cooperate in the field of river basin management, flood protection, drinking water and wastewater treatment, mobile water purification equipment and training of specialists and we are planning the meeting of the joint technical working group at the beginning of the next year.

- We were honored in October this year to receive in Budapest Minister of Jal Shakti, His Excellence Mr. Shekhawat who participated in the Budapest Water Summit and during his visit minister Shekhawat met several high-level political leaders including the President of Hungary who was the Chairperson of the Budapest Water Summit but apart from that he took time to learn about Hungary and water technologies.

- We need joint research and joint development programs and that is what we are doing basically. And when we talk about mindset and education that's long term project, but to have more experts more people who are ready to work in this field the classical education and cooperation is very important and I'm very proud to say that we do offer 200 fully paid scholarships to India every year for Hungary Universities around 200 courses everything in English and it's BA, MA, PhD studies, and among the PhD studies, unofficially, I can say that we have around 20 or as far as I know 18 seats which are related to water.

Water has not all of a sudden become a main topic it has been a central topic for all our civilizations wherever you go in our past traditions, water has always been a central element no matter whether it's Greek tradition or Babylonian or Persian or Indian or Chinese. Water together with earth, wind and fire has always been a central element but indeed you are right in saying it is under severe stress, enormous stress because of several reasons.

- Water has become a central focus of our bilateral Indo-German Partnership. Also, not today and not yesterday but in fact more than 4 years ago with Prime Minister Modi and Chancellor Merkel signing up to a partnership for the Namami Ganga Rejuvenation. We are very happy to lend our experience that we have gone through with cleaning the Rhine River and probably we can later back the philosophy of what's the best way to clean a river because the best way to clean a river is simply not polluting it.

- It is also important to manage our expectations regarding technological solutions. There is no miracle solution. There is not some medicine that you simply add to the Ganga water in order to get it clean. It's a much more cumbersome and holistic process. But in holistic mean, there have been times when you said you simply build dozens of sewage treatment plants at the border of the Ganga River, and today, we know it doesn't help at all. If you have them you also have to have a

huge system bringing the wastewater to the sewage treatment plants, you have to have powerful pumps, you have to have connectivity, connection to the factories, to the farmers, to the municipalities, to the individual households, very cumbersome in particular if they have to pay for dumping their wastewater which is a mentality thing.

- Internalizing the cost is about worth, and it's cumbersome to make consumers pay, individual households to pay for dumping wastewater. We have this in Europe, and it has also been very difficult to get that through but today it is largely accepted.

- I don't think that money is the biggest problem. If we had the World Bank representative at the table, he could have very huge figures about what the World Bank is doing. As we got to Germany we have dedicated 150 million and interest rate subsidized credit lines for the Namami Ganga Mission with which we finance the upgrading of sewage treatment plants, canalization, huge pumping systems, and if we add so that's 150 million Euros, and if we add the amount that has been allocated to the other water management projects in Madhya Pradesh, in Chennai, and in Kerala then all in all that is 600 million Euros. But as I said, the money is not essential. It's the question, how you spend it and how you put your money in projects that are well-integrated into a holistic approach that brings on board all the polluters.

Global Cooperation for a Global Issue A: EU-India Cooperation on Water



MARTEN VAN DEN BERG
Dutch Ambassador to India

If you talk about Netherlands, if you talk about water and the other way around it's like a twin. Our water brought the oldest governance in Netherlands that exists already for 600 - 700 years and it's our lifeline so to say. And why is it so important. I think water is a global issue, a global challenge, a global agenda, it's a European Agenda, it's a Dutch Agenda and it's an Indian Agenda and so many levels to work at very-very closely together.

- Water and agriculture are extremely connected with each other. We know India in ways exporting water while water is extremely scarce in India. Water productivity in India is extremely low so lot of work to be done, can be done between the EU and India, the Netherlands and India working with its challenges.

- You cannot address the water issue without spatial planning through urban planning. For example, we work on Chennai enclosing the water loop. Chennai is a perfect example that one time of the year there is too much water and the rest of the year there is too little water. There are ways to really close this water loop and we have been working intensively on that and it is possible as to go.

- It's also about water governance, water management and having the

right incentive in your system if water is too cheap, if water is free, you can understand from a social point of view that definitely you'll have an over consumption. And you will create own problems so it's extremely important in social policies, industrial policies, and energy policies to think about incentives on using water.

- Of course, we need lot of capital, but capital is not the issue, I think. It's not a issue. Look around in the world how much capital there is even with very low interest rates. It's I think very much about getting the incentives right internalizing external effects in your whole pricing system which requires a huge transition.

- It's a huge coordination issue, but it's between countries because water challenges have no borders. So, you have to organize it between countries. You have also said you need the states on board. It's also sometimes specially in larger countries a domestic issue that you really get a good coordination or collaboration between the national states, the states and the cities. That is key. And of course, it's also we learnt for example in Europe. We also had very polluted rivers in Europe and we were only able to manage it with a very-very strong coordination with all the relevant stakeholders from different countries around that river.



MARJAN CENCEN
Ambassador of Slovenia to India

I was excited to hear that I'm invited to this event because I had a very personal experience with Ganga in 1991, I cycled from the source to the plains with a bicycle. I shot a documentary, I regard this now as my contribution to awareness about the beauty of India and the river itself.

- Now we are more aware of climate change and water sources are a part of this climate change and we should seize the opportunity of this political momentum because if everybody is talking about the importance of water that means that we have the chance to do sometime and I agree with what your minister said that the role of the media is very important to this as well.

- Slovenia regards water as an important part of human life that's why we did put an article into our constitution about the rights of the people to clean water and also we are part of the countries that establish the high level panel on water and peace which is chaired by our former President Danilo Turk.

- I'm very glad that you are able to visit Slovenia and get the experience how do we work on water because we are a small country, we have lots of resources including water but we are well aware that as a small country, if something goes wrong we feel big because if you are small and there is something wrong that's not good for whole population.

- So while we discuss the innovations and technology, and solving the problems that we encounter, it's also important to be innovative in our minds because it's very important that people start thinking differently when they live and how they use the resources so what's very important is also to reform the system of education and other awareness spreading among the public. So, they will make less damage and we need less technology to remove the consequences. It's important to act preventively, so that helps a lot.



STEEN MALTHE HANSEN
Deputy Chief of Mission, Denmark

As was mentioned already COP25 is taking place right now these days in Madrid and I think that of anything it illustrates how we cannot see water, energy, and climate change in isolation from each other or from sustainable development goals.

- And, so from our perspective, from Denmark's perspective we're trying to scale up how we approach climate change in general and water is a key component of that fight. The government has announced recently a goal of reduction of CO₂ by 70% by the year 2030. It may or may not be over ambitious but is certainly a kind of moonshot to achieve it by 2030.

- We also work on scientific cooperation; research projects and several Danish companies are very actively engaged around India on all these things. Some of which could be and I have to read my notes, Non-Revenue Water and Sustainable Liquid Discharge from Industrial Sector, such things that I personally know very little about but which certainly are important for the Industrial part and the discharge into the Public Water Systems, the Water Wastes of India.

- Another sector is Agriculture - key sector in India. And where you want to work to minimize water use and maximize the outcome. And ground water basin mapping is another area in which Denmark has connected.

- So, in other words we are very keen to work with, partner with India, we have actually upscaled our presence with the new expert, specifically on water, who has just arrived and who will be working in part on wastewater management here in India. So, going forward we are very keen to expand our footprint here in this respect and on the water agenda.

Global Cooperation for a Global Issue
A: EU-India Cooperation on Water

UP SINGH
Secretary, WR, RD & GR, Ministry of Jal Shakti

We identified very important nine priority areas in the EU-India water partnership. And for the first time I felt that yes, we are making some good progress actually, and that's very important, and both the sides have been fairly happy with the progress which has been made in these times.

- The other important factor is that as you are aware that water in India is a state subject actually, and taking states on board is very-very important. So, in the Tapi basin project, for example, we found that all the states whether it's Gujarat or Madhya Pradesh or Maharashtra, they all are on board actually.
- I don't think financing is such a big issue even though the public financing is very important. My colleague Mr. Parameswaran Iyer, made a presentation, and said how four P's are important and one of the P's was public financing, and he said how Swachh Bharat Mission was funded, and now a huge funding government has committed towards providing tap water to every household. So, if your priorities are there, I don't think funding is such a big issue.
- Take the case of Ganga, we are all the time basically accused in a way of spending too little in fact 20,000 crores would mean about 3 billion and that was basically available for us for 5 years up to 2020. And we have been able to utilize only one fourth of that so far. So, it is not only basically a financing so much and there is a business case or revenue model also.
- The other day we were discussing the Honorable Prime Minister, he says that why can't sewage which is basically otherwise we call it a waste could be a very useful resource right from whether you generate electricity out of it. Now there are number of, even in Delhi, there are sewage treatment plants where 75% electricity gets generated from the plant itself.
- The pricing of water is very important. Tomorrow if the pricing of water is there, the treated water which you can sell it to let's say a power plant or something could be a very good source of revenue and that's what's happening in Nagpur, the company is not going to recover the cost of the tertiary treatment and transportation but it makes some money and part of that money is being shared with the concerned municipal corporation.
- There could be, even sludge has a lot of use. These days we are discussing with a lot of companies where they see a lot of value in sludge so there could be a proper kind of policies or proper kind of an environment perhaps this entire sewage management could turn out to be good revenue model or a good business case also. So, funding I don't think is such a huge issue, but yes, I'm very happy that it's a very complex process as has been said.
- So, what is more important in my opinion is not basically a funding so much or the lack of funding, but other right from whether it's a policy or whether its behavioral change or whatever, those things in my opinion are more important.

Global Cooperation for a Global Issue
B: India's Collaboration on Water with other Nations

RON MALKA
Ambassador of Israel to India

Water is life and we consider ourselves a water respectful culture, that's how we define ourselves. Of course, Israel, mostly desert country, 60% Israel is desert and rest is semi-arid area.

- I can tell you that 35 years ago, as a young officer in the military everybody was so positive that there is going to be war in the Middle East about water. It was then so obvious because the scarcity of the water was going rapidly but there was never a war about water in the Middle East because since then due to innovation and creativity we have developed so many techniques to overcome the challenge.
- As they said that Israel has proved the concept of overcoming the water challenge, how we can bring those technologies and experiences here in India to make the adjustments, because we understand that there are differences in culture, structure, political differences, we have to take all these differences in consideration. Its not just bringing in their experiences and technologies but working together experts from Israel and experts from India in adjusting and implementing those technologies, approach together to make them suitable to India to overcome water stress here in India.
- During the last 70 years, annual rainfall has dropped by 50% and population of Israel has gone 15 times since last 70 years. We still have abundance of water so we want to bring all those technologies and to share them with a closer friend like India.
- In order to get efficiency in water you might need to charge people for using water, well its obvious. But we also need to be more creative, flexible in customising and adjusting those solutions to the specific cultural ecosystem structure here in India.
- Back in Israel we don't really charge for water, we charge for clean water available in the tap. So, its actually about the management of water but not the water.
- Its not enough to bring solutions from other places, we need to work together to implement to adjust and to customise the condition here in India.



MIKE OQUAYE JR.
High commissioner of
Ghana to India

Water has no borders and I think that its very impressive that India has recognised and called Africa to the table.

- We do share the Indian Ocean with you and anything that we do to impact the Indian ocean for instance, therefore impacts India. On the European side we do share Atlantic with part of Europe and the American.
- I was very happy to hear when Israel said that they are very much a desert country and yet have managed to secure water for all aspects.
- Israel has technology to convert sea water into drinking water and we have a lot of fresh water in our country and yet we are not able to transport it for the citizens to drink so this is something we have to look at.
- We all have to work together to fight climate change because we are witnessing extreme conditions such as the drought you had in Chennai and the draught we had in Savanna region of Africa.
- We are very excited to be a part of the Ganga river project. Ghana is brother to India albeit a younger and less populated brother and we intend to learn how Indians are cleaning the Ganga which is bigger than many other rivers we have. So, if they can manage it we would want to work with them to learn to manage our own rivers.
- Ghana has particularly realised, its not just water that is important but we need cleanliness and sanitation as well, and so for the first time in Ghana we have put together the Ministry of Water and Sanitation, and sanitation has been taken away from the local government. We realised that if we want to prevent diseases like cholera, we have to understand that contamination of water bodies that causes it.
- Now, the President of Ghana has also come up with a Policy which is called "One Village One Dam". In the whole of the northern part of Ghana, every village and district we are going to have a dam. The dam will be used to achieve two things, water conservation and irrigation.

Global Cooperation for a Global Issue

B: India's Collaboration on Water with other Nations



JENO LABDY
Deputy Director General,
General Directorate of Water Management, Hungary

I am pleased to represent General Directorate of Water Management. This organisation is responsible for water management in Hungary. We are also involved in Hungarian Indian Corporation and the execution of MoU between two countries.

- Water has become one of the key factors of sustainable development in Hungary and also worldwide. Illustrating the water related responsibilities of the government - "Reserves of water shall form a common heritage of the nation, it shall be the obligation of the state and everyone to protect and maintain them and preserve them for the future generation".

- The capital of Hungary has considerable freshwater resources as compared to the world. However, the special and temporary distribution of these resources is extremely irregular. Our experts are facing the problem of too much and even lack of water. Nevertheless, 95% of our surface water comes from abroad and flows to other countries. Furthermore, the majority of our water resources are divided by national borders.

- Clean drinking water and sanitation are essential for healthy life. The access to safe drinking water is indeed a human right. In order to safeguard it everyone has to join forces and work together.

- The increasing frequency of extreme weather condition caused by climate change requires more attention and preparation from before. Hungary also has to face floods and droughts in increased frequency. These extreme weather conditions often occur in the same year with slight time difference.

- Hungary has gained immense experience and knowledge in water management, irrigation, agriculture and flood control. The latter is proven by successful coordination and efforts of our citizens and people. We are able to provide assistance even to our neighbouring countries in their efforts to fight against the flood regularly.

- We have several areas of best practices and we have also been open in sharing of the knowledge concerning water, and I hope this event can be one step on this way.

Technology Collaboration Agreements (TCA) for companies selected from European Union for the Environment Technology Verification (ETV) Process

- Boson Energy, Luxembourg | *Waste to Energy*
- Cambi, Norway | *Sludge Management*
- GVS Soluciones, Spain | *Containerised Effluent Treatment*
- Space SI, Slovenia | *Remote Monitoring through Satellite Systems and Analysis*
- VGB Maribor, Slovenia | *3D Flood Inundation Modelling*

Technology Collaboration Agreements (TCA) companies selected from rest of the world for the Environment Technology Verification (ETV) Process

- Alchemy AI, UK | *Artificial Intelligence System*
- Aquatech, USA | *Containerised Sewage Treatment*
- Blue Sky Bio, UK | *Advanced Anaerobic Digestion*
- Celtic Renewables, UK | *Distillery Waste to Biofuels*
- Exo Cubic Systems, UK | *Waste Tyre and Plastics Management System*
- GMEX Group, UK | *Waste Trading Platform*
- Lyndon Water, UK | *Bioremediation and Aquaponics*
- Mebiol, Japan | *Membrane based Farming System*
- Topolytics, UK | *Waste Tracking and Management System*
- Trojan UV, Canada | *UV Water Treatment*

Global Cooperation for a Global Issue



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TRACK

A

SCIENCE AND POLICY FOR INTEGRATED WATER MANAGEMENT AS A KEY CONCEPT IN NAMAMI GANGE PROGRAMME

DAY 2:

Friday, December 6, 2019
14:00 – 15:30 h, 16:00 – 17:30 h

DAY 3:

Saturday, December 7, 2019
10:00 – 11:30 h, 12:00 – 13:30 h

VENUE:

Hall 2, Vigyan Bhawan,
New Delhi

CHAIR:

Rajiv Ranjan Mishra [DG, NMCG]

MODERATORS:

Vinod Tare [Head, cGanga, IITK]
Pravin Kumar [Director (T-III), NMCG]

LEAD DISCUSSANTS:

Abhishek Malhotra [Technical Director, AECOM]
AK Srivastava [Director General, Network for Certification and Conservation of Forests]
Akash Sondhi [Assistant Professor, Department of Energy and Environment, TERI]
Amit Kaur Puri [Scientist, Apeejay Stya University]
Anjali [2030 Water Resources Group of World Bank]
Asghar Nawab [Programme Head, Wetlands International]
Ashok Ghosh [Chairman, Bihar State Pollution Control Board]
Atul Agrawal [Managing Director, DHV]
BK Agarwal [President, Triveni Engineering & Industries Ltd]
B Sen Gupta [Ex Member Secretary, CPCB]
Bharat Sharma [Emeritus Scientist, International Water Management Institute]
Gian N Kapthalia [Chairperson, Alternatives Futures]
Girija Bharat [Founder Director, Mu Gamma Consultants Pvt Ltd.]
Jagdish Kumar Bassin [Consultant, National Water Mission]
Manoranjan Kumar Singh [Assistant Scientific Officer, Bihar State Pollution Control Board]
Nitin Bassi [Principal Researcher, Institute for Resource Analysis and Policy [IRAP]]
Nitin Kaushal [Associate Director, WWF]
Paritosh Tyagi [Former Chairman CPCB]
Paromita Chakraborty [Associate Professor, SRM Institute of Science and Technology]
Raman Kumar [Infrastructure Lead, Jacobs International]
Ranjana Chaudhuri [Lecturer, TERI School of Advanced Studies]
Ritesh Kumar [Director, Wetlands International]
Ravindra Kumar [Consultant, WWF, India]
Satpal Singh [Research Officer, National Institute of Urban Affairs]
Shachi Shah [Associate Professor, IGNOU]
UN Rai [Professor and Senior Principal Scientist, NBRI, Lucknow]

THEMES

- **Restoration and Conservation of Drains I – Using Urban Stormwater Drains as Integral Components of Water Resource Management**
- **Restoration and Conservation of Drains II – Development of Wetlands and In-situ Treatment**
- **Enabling the Circular-Economy I – Developing Direct and Indirect Revenue Streams for Recycling Water**
- **Enabling the Circular-Economy II – Water Valuation and Pricing**



A1: Restoration and Conservation of Drains I – Using Urban Stormwater Drains as Integral Components of Water Resource Management

A1.1. PROBING THOUGHTS

Integrated water resource management and river basin management requires the management of the river network in its totality, instead of focussing only on the main stem of the river. Developing the inter-connections of water bodies and conveyance channels in the area can create a balanced ecosystem for anthropogenic water needs that optimizes the regenerative capacity of the receiving water bodies and maintains a healthy

water environment in the region. Most urban conurbations have large drains and natural watercourses that discharge into rivers flowing through or near the cities. The interception-diversion technique of taking anthropogenic wastewater away from the city through the drains before treatment and discharge into the receiving rivers and water bodies is commonly practiced in India. But this requires large infrastructural spend; and it still does not address the problems created by natural



Restoration and Conservation of Drains I – Using Urban Stormwater Drains as Integral Components of Water Resource Management

drains carrying urban sewage and other wastewaters through the hearts of cities. But these natural drains can be much more beneficial as hygienic channels of stormwater and treated wastewater that are ecologically integrated with the receiving water bodies. Hence, the holistic approach to restoration and conservation of drains would require tapping wastewater at source and treating the sewage substantially before transferring to the drains for downstream conveyance to water bodies. Ideally this implies localized sewage collection networks and treatment plants discharging into the drains from the head-end of drains to various points down-slope, that is, complementing sewage treatment with the subsequent natural treatment capacity

of the drains and rivers. The overall benefit would be to create a healthy water environment in cities and the ecological integration of urban natural drainage networks with downstream water bodies.

A1.3. DISCUSSIONS

Low-order tributaries of large rivers are key components of river networks. Thus, the dual role of natural urban drains/streams as tributaries of larger rivers in maintaining the main river's ecological balance as well as in improving urban environments is essential. Since urban drains are a major source of wastewater inflows to rivers, their restoration as clean water drainage systems can provide valuable eco-hydrological inputs for the rivers. Moreover, such restoration will



A1.2. KEY QUESTIONS TO BE RESOLVED

Focussing on receiving water bodies in isolation has led to complex problems in the integrated management of water resource systems in and around urban habitats. To meaningfully integrate urban water-wastewater management and urban drainage with the receiving rivers, some issues that need to be addressed are:

- 1 **Can natural urban drains be restored to clean water drains and integrated into the local water resources network for treated water conveyance round the year?**
- 2 **What are the health, aesthetic, cultural, flood control and other benefits that may accrue from the restored urban drainage systems?**
- 3 **Can the restored drains provide other socio-economic services such as navigation, fisheries, water storage, and recreation?**
- 4 **For cities with existing sewage infrastructure, what modifications will be needed to ensure that drains are used for treated water conveyance (by treating wastewater in STPs before diverting it into drains) and how can they be achieved in the foreseeable future?**
- 5 **National/ international case studies of the above usage of natural drains in urban water resource management.**



ensure a healthy aquatic environment in cities and provide a local source of freshwater. For example, River Yamuna's restoration cannot be achieved without restoring the degraded urban drains/ rivers, such as the Najafgarh and Shahdara drains in NCR that disgorge into the Yamuna. Thus, while we may need more STPs in many cities, the numbers, sizes, and locations of the STPs should be aligned with the long-term goal of restoring the urban drains as perennial rivers. Ideally, therefore, sewage collection and treatment should be carried out in a decentralized manner to feed the treated sewage after desired quality enhancement into the drains at various points down-slope instead of intercepting the drains near their downstream ends for sewage treatment in large STPs. Each such tributary, river or natural drain should be governed by its own River Basin Organization (RBO) as

the river's custodian, comprising mainly of the river's stakeholders. Such river-specific RBOs can ensure the steady – if time-consuming – process of restoring the urban drains/ rivers as healthy freshwater bodies. RBOs may aim to achieve the goal of restoring the drains as perennial freshwater streams through progressive stages of improvement over time in urban drains/ rivers from aesthetic (where the river is visually appealing and without bad odour) to being safe for human contact, floodplain reclamation and having indigenous freshwater biodiversity. Moreover, uniform standards for sewage treatment and river classification should give way to standards and benchmarks being set by the local governance bodies/ RBOs as per specific local situations and requirements. Some issues that need further clarification are: (i) Who should be considered as stakeholders of the urban rivers – all water-users/ river-

**EACH TRIBUTARY,
river or natural drain
should be governed by its
own River Basin
Organization (RBO) as
the river's custodian,
comprising mainly of the
river's stakeholders**

Restoration and Conservation of Drains I – Using Urban Stormwater Drains as Integral Components of Water Resource Management



users and government/ non-government agencies that use river services or only citizens and local bodies who have a direct stake in the status of urban rivers? (ii) Can any guidelines be developed to help RBOs in setting standards or benchmarks for water quality and status of their rivers? (iii) How can the

existing sewage infrastructure of tail-end interception-diversion of wastewater to large STPs be economically adapted to suit the distributed sewage treatment and discharge model of the present scheme? (iv) How can the emerging problems of micro-plastics and pharmaceutical residues in municipal sewage be

handled by the STPs? (v) Can third-party monitoring and evaluation be adopted for this scheme of urban river restoration?

A1.4. RECOMMENDATIONS

The wide-ranging discussions presented above led to the following main recommendations:

1. Urban water bodies are vital for both urban environments and the larger river ecology.
2. For major urban drains discharging into nearby rivers, River Basin Organizations (RBOs) comprising key stakeholders should be established as custodians of the respective degraded urban streams to enable their restoration and conservation as healthy, perennial streams.
3. To achieve the above target,

decentralised sewage collection and treatment for disposal of the treated wastewater of desired quality throughout the length of the drains/ streams should be adopted.

4. The integration of existing sewage infrastructure with the intended decentralised process may be planned appropriately by the RBOs in consultation with local governance bodies.
5. The restoration of urban streams may be achieved in stages from aesthetic satisfaction to achieving ample indigenous freshwater biodiversity.
6. RBOs and local governance bodies should decide on the desired standards of sewage treatment and of river water quality based on specific local conditions and requirements.

UNIFORM STANDARDS FOR
sewage treatment and river classification should give way to standards and benchmarks being set by the local governance bodies/ RBOs as per specific local situations and requirements

TAKE AWAY POINTS

Establish RBOs – comprising of stakeholders of the rivers – to act as custodians for each major urban drain/ stream feeding stormwater and municipal wastewaters into nearby rivers and water bodies.

RBOs shall be tasked with the revival of respective urban drains/ streams as perennial clean-water rivers through decentralised sewage treatment and disposal along the length of the drain/ stream.

The integration of existing sewage infrastructure with the intended decentralised process may be planned appropriately by the RBOs in consultation with local governance bodies.

The restoration of urban streams may be achieved in stages from aesthetic satisfaction to achieving indigenous freshwater biodiversity.

Working group (cGanga, NMCG, CPCB) to develop further understanding on various aspects and produce standard guidelines.

Restoration and Conservation of Drains I – Using Urban Stormwater Drains as Integral Components of Water Resource Management



A2: Restoration and Conservation of Drains II – Development of Wetlands and In-situ Treatment

A2.1. PROBING THOUGHTS

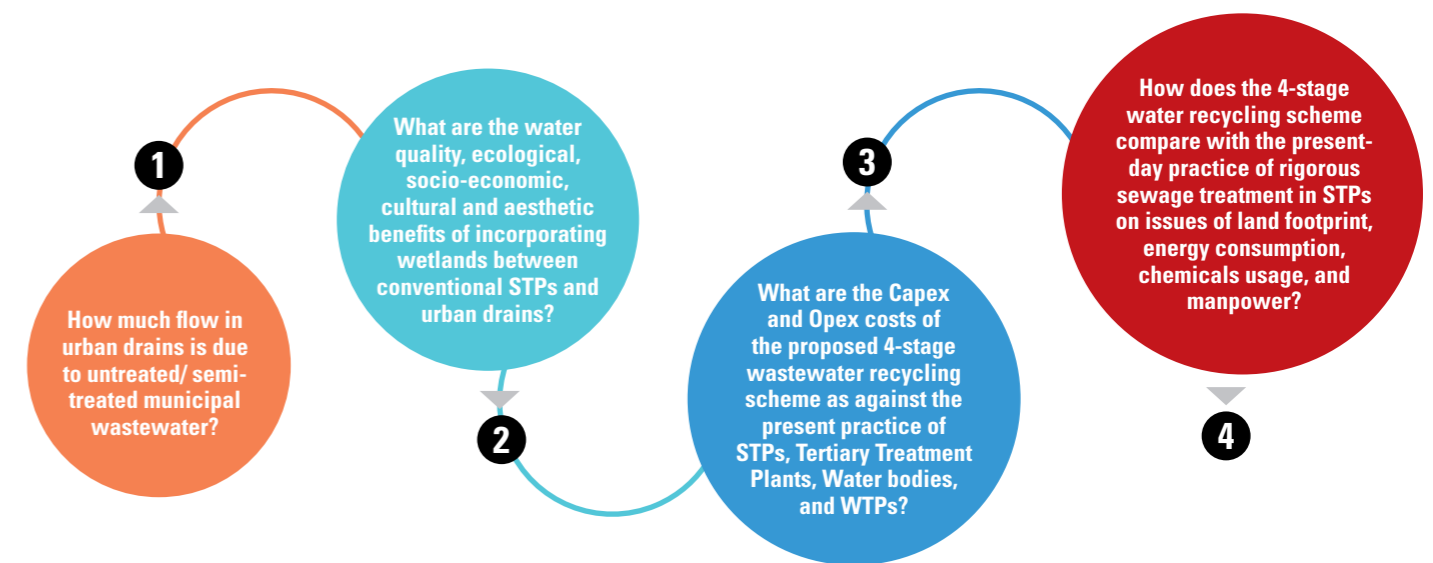
One of the useful methods for quality improvement of municipal wastewater is the phytoremediation processes that can remove various organic and inorganic pollutants, and especially excess nutrients such as Nitrogen and Phosphorus, from the water, before discharging it into rivers or other water bodies. The process occurs naturally in wetlands such as marshes and swamps, and is mimicked by constructed wetlands where natural wetlands do not exist. Thus, while conventional Sewage Treatment Plants (STPs) can remove biodegradable organic pollutants and suspended

solids effectively, phytoremediation can play a complementary role in efficient nutrient removal and polishing of the STP-treated water. A transition from current wastewater management practices to one that incorporates natural treatment and purification processes would thus involve three stages of quality improvement, namely, sewage treatment in conventional STPs, nutrient removal and polishing treatment by phytoremediation in wetlands, and further purification in natural drains and receiving water bodies. The drains and water bodies would thus be free of urban pollution ingress as well as excess nutrient loads,



A2.2. KEY QUESTIONS TO BE RESOLVED

An appropriate investment option for urban wastewater management is the incorporation of natural drains together with wetlands for comprehensive water quality management. Some pertinent issues to be considered in this configuration are:



which will enable a healthy ecosystem for aquatic biodiversity. Moreover, in this case the urban drains and water bodies would themselves be reliable sources of freshwater for municipal water requirements. Overall, the procedure constitutes a four-stage water recycling process for urban usage, viz.: treatment of wastewater in STPs, further improvement and nutrient removal in wetlands (natural or constructed), natural purification in drains and water bodies, and treatment of freshwater in WTPs for municipal usage.

A2.3. DISCUSSIONS

Urban wastewater management and river management can be advantageously combined into a mutually reinforcing scheme by integrating primary and/or secondary treatments in STPs with natural treatment processes in wetlands and watercourses. Thus, sequential treatment through STPs, wetlands (natural or constructed), and urban drains can progressively improve the water quality significantly for discharge into inland water bodies or tapped as freshwater source. A key





CONVENTIONAL SEWAGE

Treatment Plants (STPs) can remove biodegradable organic pollutants and suspended solids effectively, and phytoremediation can play a complementary role in efficient nutrient removal and polishing of the STP-treated water

advantage of this scheme of wastewater management is that excess nutrients (N and P) in municipal wastewaters will be removed efficiently in the wetlands instead of expensive nutrient removal technologies needed otherwise to prevent eutrophication of water bodies. Secondly, temporary short-term failures/ shutdowns of the STPs would not significantly affect the drain water quality due to the buffering capacity of the wetlands. Consequently, stringent standards for treated water discharge from the STPs will not be needed, and satisfactory water quality in the drains would be indicated by the abundance of native freshwater biodiversity in them. However, algal and plant growth in the wetlands will have to be periodically removed to prevent eutrophication in the drains/ streams, but the harvested biomass can generate significant revenues as a source of bio-fertilizers, bio-fuels and bio-energy. RBOs set up for specific urban streams/ drains can thus restore the urban streams reliably, while municipalities will benefit from locally available freshwater in the urban streams without the need for expensive water reuse and recycling infrastructure or importing water from distant sources.

A2.4. RECOMMENDATIONS

The in-depth discussions presented above led to the following main recommendations:

1. Natural or constructed wetlands are ecologically safe, hygienic and economic means of nutrient removal and quality enhancement of municipal wastewaters.
2. The wetlands are also a safety buffer that can temporarily shield the receiving drains from untreated wastewater.
3. Uniform and stringent standards of STP-treated water are not needed.
4. Wetlands need to be regularly rid of excess biomass, and the harvested biomass can generate revenue as a source of bio-fertilizers, bio-fuels and bio-energy.
5. Municipalities can benefit from locally available freshwater in urban streams without expensive water treatment and recycling infrastructure or importing water from distant sources.



TAKE AWAY POINTS

Adopt safe, hygienic and economic means of nutrient removal and quality enhancement of municipal wastewaters by incorporating natural or constructed wetlands in a 4-layer treatment cycle.

Wetlands also temporarily buffer the receiving drains from untreated/ semi-treated wastewater from STPs.

Uniform or stringent standards of STP-outlet water are not needed.

Wetlands need to be regularly rid of excess biomass growth, with the harvested biomass generating revenue as bio-fertilizers, bio-fuels and/or bio-energy.

Municipalities will benefit from locally available freshwater in urban streams without resorting to costly water treatment and recycling infrastructure or importing water from distant sources by adopting the 4-layer treatment cycle.

Restoration and Conservation of Drains II – Development of Wetlands and In-situ Treatment



A3: Enabling the Circular-Economy I – Developing Direct and Indirect Revenue Streams for Recycling Water

A3.1. PROBING THOUGHTS

Freshwater taken from source – groundwater or surface water – has its own monetary value. But in addition to this base value, circular economy can augment the monetary value of the water significantly. The principles of circular economy in the water sector rest on being able to recycle the wastewater and monetize it through urban local bodies or other agencies. Application of this principle can generate much-needed additional revenue for local bodies from recycled water and water-based services. The issue is important because, in order to effectively implement and conduct urban river management strategies with limited resources, it is essential to establish well-functioning revenue generation streams. When implemented, such revenue streams will not only move a significant development burden off the Government, but will also create

additional pathways of effective action for holistic water management and improved public services by urban local bodies.

A3.3. DISCUSSIONS

Revenue generation from urban water and wastewater management needs to be coupled with savings in expenditure. Thus, expensive nutrient removal technologies for STP-treated sewage can be effectively substituted by natural or constructed wetlands whose operational costs (including energy and chemical inputs) are far less and can be partially offset by revenue generation from harvested biomass. Treated or semi-treated water from STPs can also be commercially used in industries for washing and as cooling water. The concept of 24x7 urban water supplies needs to be revisited for – although the Indian water supply system is designed for continuous operation and is liable to greater wear and tear from pressure

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A3.2. KEY QUESTIONS TO BE RESOLVED

Some important issues that need to be addressed in this context are:

- 1 How much recycled water can be used by industries and commercial establishments in and around cities to meet their overall water requirements, and how much revenue can be thus generated?
- 2 How much recycled water can be used in water-based commercial services such as recreational activities (e.g. water parks, boating clubs, recreational fishing, etc.), and how much revenue can be thus generated?
- 3 How can cities benefit from the use of treated water in urban drains, waterways and water bodies, and how much revenue can be generated from such water management practices through enhanced uses of rivers and river banks, waterways, lakes and ponds?
- 4 How can the private sector be roped in to increase municipal revenue generation from recycled water and water-based services, e.g. through PPP model or through BOOT-type contracts?



Enabling the Circular-Economy I – Developing Direct and Indirect Revenue Streams for Recycling Water



fluctuations induced by periodic starts and stoppages, and to consequent leakages and polluted water inflows – the operational costs and freshwater abstractions are likely to be much less for limited duration supplies. The concept of dual piping for reuse of wastewater for toilet flushing in residential complexes and buildings also needs to be reviewed in view of the significant additional pumping costs and frequent leakages and foul odour from the recycled sewage water. Thus, the sewage management expenditure needs to be minimized by adopting cost-effective methods both at the municipal level and at user ends.

A3.4. RECOMMENDATIONS

The extensive discussions presented above yielded the following main recommendations:

1. Revenue generation from urban water

and wastewater management needs to be coupled with savings in expenditure.

2. Expensive and sophisticated nutrient removal technologies for STP-treated sewage should be substituted by cost-efficient natural or constructed wetland treatment.
3. Treated or semi-treated water from STPs can be commercially used in industries for various purposes such as washings and as cooling water.
4. The concept of 24x7 urban water supplies needs to be revisited to reduce operational costs and freshwater abstractions.
5. The mandatory need for dual piping for reuse of wastewater for toilet flushing in buildings needs to be reviewed to reduce additional pumping and maintenance costs and check problems of leakages and foul odour in the buildings.

TAKE AWAY POINTS

Savings in expenditure must be coupled with revenue generation from urban water and wastewater management.

Expensive and sophisticated nutrient removal technologies for STP-treated sewage should be substituted by cost-efficient natural or constructed wetland treatment.

Treated or semi-treated water from STPs can be commercially used in industries for washings and as cooling water.

The concept of 24x7 urban water supplies needs to be revisited to reduce operational costs and freshwater abstractions.

The mandatory need for dual piping for reuse of wastewater for toilet flushing in buildings needs to be reviewed to reduce pumping and maintenance costs and check problems of leakages and foul odour in buildings.

Enabling the Circular-Economy I –
Developing Direct and Indirect Revenue
Streams for Recycling Water



A4: Enabling the Circular-Economy II – Water Valuation and Pricing

A4.1. PROBING THOUGHTS

Urban water supply (of potable quality) is an essential public service by the government. However, the service is not without its costs. Thus, municipal bodies often charge consumers at certain rates, either fixed charges or volume-based charges. But the actual expenses incurred by public authorities for treatment and supply of water and

for the collection, treatment and disposal of wastewater is often far more than the revenue generated from water charges. Not valuing and/or informing the public regarding expenditures incurred in bringing water to their doorsteps and transporting and treating the wastewater brings about in people's minds the notion that water is a value-free resource, thus creating a major public resistance for

price introductions or tariff increases. However, the subsidized provision of water is a major cause for over-stressing the water management facilities, straining government resources, and depleting local water sources. The mechanism is thus unsustainable even on the current demand curve, let alone its viability if demand increases. Besides, upgradation of the water infrastructure

to provide better services to consumers or to meet quality and quantity constraints of water sources also needs increased resources. It is, therefore, necessary to devise suitable means of creating the right water cost and pricing regime, which in turn will also help create the circular economy for realistic valuation of recycled water and water-based services.

REALISTIC VALUATION
and pricing of water is a must to meet the huge financial needs over the long term for efficient management and upgradation of municipal water services

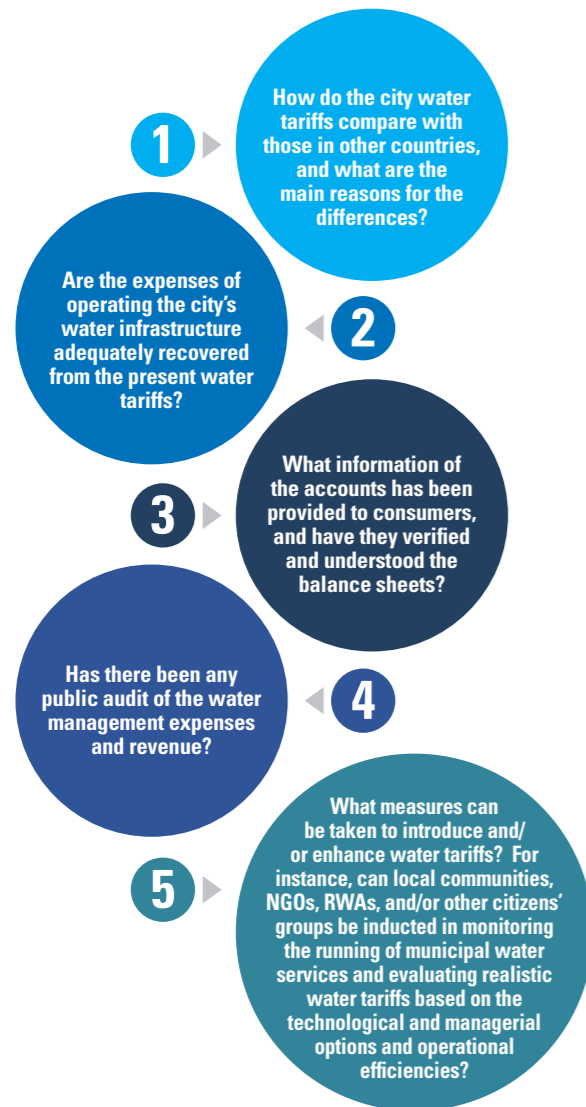


Enabling the Circular-Economy II – Water Valuation and Pricing



A4.2. KEY QUESTIONS TO BE RESOLVED

Some important issues that need to be addressed in this context are:



A4.3. DISCUSSIONS

Upgradation of public water and wastewater management in India depends mostly on government programmes and funding. While such programmes – e.g. Namami Gange and AMRUT – are time-bound over periods of only a few years and the funds available cater to only the needs of specific projects in the water sector, the vast financial resources required over an extended period of time to overhaul and sustain the water infrastructure efficiently must, therefore, be aggregated from sources other than the government. Among the most important of these sources is the pricing of water, which needs to be rationalized through a realistic valuation of water as a resource and water treatment and supply as a service. Hence, it is necessary to inform and involve citizens in municipal water and wastewater management in order to generate public awareness and understanding that can not only improve the water infrastructure through responsible citizen behaviour, but also enable realistic pricing of water. For instance water is sold in Delhi for prices up to Rs.100/kL, whereas municipal supplies of good quality water can be much cheaper. For industrial needs, too, ZLD (Zero Liquid Discharge) becomes economical in water-scarce regions such as Tirupur. Internationally, many countries



include both the cost of water supply and wastewater treatment as a single item in the cost of water, while some countries like Denmark also include the cost of preserving the freshwater sources. Thus, the rational price of freshwater supplied should be at least more than the cost of treated wastewater to enable efficient and economic use of freshwater and treated water.

A4.4. RECOMMENDATIONS

The multi-faceted discussions presented above led to the following main recommendations:

1. Much greater financial resources are needed over the long term for efficient management and upgradation of municipal water and wastewater infrastructure, for which valuation and pricing of water is a must.
2. Informing and involving citizens in municipal water and wastewater management are needed for responsive citizen behaviour and water tariff rationalization.
3. Many foreign countries include the costs of water supply, wastewater treatment, and the preservation of freshwater sources in the cost of water for consumers, a practice that needs to

- be emulated in India.
4. Commercial reuse of treated water can only be promoted if freshwater isn't dirt-cheap. Hence the price of freshwater or water supplied should be at least more than the cost of treated wastewater for efficient and economic use of both freshwater and treated water.

A4.5. TAKE-AWAY POINTS

- Realistic valuation and pricing of water is a must to meet the huge financial needs over the long term for efficient management and upgradation of municipal water services.
- Citizens should be adequately informed and involved in municipal water and wastewater management for responsive citizen behaviour and water tariff rationalization.
- Lessons need to be learnt from foreign countries who include the costs of water supply, wastewater treatment, and the preserving of freshwater sources as a single item in the cost of water for consumers.
- The price of municipal water should be at least more than the cost of treated wastewater to enable efficient and economic use of freshwater and treated water.

IT IS NECESSARY

to devise suitable means of creating the right water cost and pricing regime, which in turn will also help create the circular economy for realistic valuation of recycled water and water-based services



SEQUENTIAL TREATMENT
through STPs, wetlands (natural or constructed), and urban drains
can progressively improve the water quality
significantly for discharge into inland water bodies or
tapped as freshwater source

TRACK

B

WATER FINANCE FORUM

DAY 2:

Friday, December 6, 2019
14:00 –15:30 h, 16:00 –17:30 h

DAY 3:

Saturday, December 7, 2019
10:00 –11:30 h, 12:00 –13:30 h

VENUE:

Hall 1, Vigyan Bhawan,
New Delhi

CHAIR:

SK Ratho [DDG, NMCG]

MODERATORS:

Sanmit Ahuja [Expert, cGanga, IITK]
Rozy Agrawal [EF(F), NMCG]

LEAD DISCUSSANTS:

Anand Rudra [Sr. Advisor, USAID]
Anil Sinha [Sr. Advisor, 2030 Water Resources
Group, World Bank]
Donal Cannon [Head of Region, European
Investment Bank]
Jai Shankar [CEO, IIFCL Projects]
Kavita Sachwani [State Program Coordinator,
2030 WRG, World Bank]
Madhava Kumar [Manager, NMCG]
Mahesh Patankar [Sr. Advisor, 2030 WRG,
World Bank]
Manish Jain [Partner, Envint]
Manjay Verma [Sr. Manager, VA Tech Wabag]
Palash Srivastava [Deputy CEO, IIFCL Projects]
Ram Kumar Jaglan [Deputy GM, Union Bank
of India]
Rishad Abraham [Chief of Staff, Social Finance]
Saurabh Daspatnaik [CEO, Swachh Environment]
Srini Sundaram [CEO, Agvesto]
Simon Gill [Managing Director, Quantum
Capital Investors]
Subrata Ghosh [SREI Infrastructure Finance]

THEMES

- Blended Finance Approaches in the Water Sector and Innovative Financial Instruments
- Development of a Water Bond / Ganga Bond
- Innovative Financial Instruments for the Water Sector – Fintech & Digital Solutions



WATER
MANAGEMENT

Blended Finance Approaches in the Water Sector and Innovative Financial Instruments



FINANCING of projects in the water sector requires large pools of capital. Credit constraints in the Indian banking system is impacting the financial closure of the projects which in turn is impacting the water resources of the nation. It is abundantly clear that public and private sources will need to pool the resources to make projects more bankable and thereby increase the throughput and availability of project finance to the sector. This session deliberated on following aspects:

- Blended finance in the water sector projects
- Pooled financing vehicles
- Financing O&M through transfers, taxes and tariffs
- Moving water sector to the “priority lending sector”
- Credit enhancement instruments
- Telescopic pricing and tariff top-ups
- Backstop and guarantee instruments

KEY POINTS RAISED AND DEBATED ON BLENDED FINANCE

There is a real need to expand the sources of financing for water and other critical infrastructure. Relying on Government or developmental sources alone is not prudent and it is important to attract more commercial financing to the sector. This in the past has not been easy as the commercial sector seeks higher returns or more Governmental guarantees which the water sector, for the most part and at least in India, is unable to offer. This usher in the concept of blended finance that enables the convergence of

developmental and commercial finance.

It was noted that in India, less than 5% of the CSR funds were going into the water sector. Although there are large Government financing sources available either directly or through multi-lateral financing, there is still a need to mobilize commercial funds to the sector.

In the continuum of finance, there is philanthropy, there are CSR funds and then the pure-play commercial investors. But CSR barely scratches the surface with less than 5% of all available capital is directed towards the water sector. How does one marry that in a concentrated effort to solve a development problem? And that is blended finance.

- Blended finance comes in many forms, some funds provide first or second loss thereby reducing the risk for commercial lenders, others provide credit enhancement instruments, whilst some would just be happy to make lower returns so that much more

THE HYBRID
Annuity Model (HAM) is a good PPP framework to usher in the outcome-based financing

Blended Finance Approaches in the Water Sector and Innovative Financial Instruments



commercial capital can be mobilized. Internationally, a lot of capacity building and technical assistance capital is being spent alongside blended finance to fill in the necessary gaps. But the alignment of interest amongst all parties is crucial.

- Outcome-based financing structures are another variation of high impact capital and if adopted properly, can add a lot of fillip to the sector. For instance, the Government incentivizes the commercial developers/ implementing agency and impact investors sector to finance a project that is focused on delivering certain outcomes, such as aquifer recharging or improving water use efficiency in the agricultural sector. Should the implementing agency achieve that goal, then the Government pays in the promised amount, with a premium if needed. This really focuses on the efforts of all parties to achieve the desired results. However, great care should also be taken, to not allow the system to be gamed.

- There is a critical concern raised by private sector which is what happens to

Government financing for projects that go beyond the standard 5-year term of any Government. It was stressed, that this should not be a cause of concern as any centrally sponsored scheme will continue to fund the projects even if the Government was to transition. Concessionaires nonetheless have raised concerns around their ability to get financial closures for projects under the Hybrid Annuity Model (HAM). The lenders need clear visibility of funding for the entire period of concession.

ABOUT HYBRID ANNUITY MODEL (HAM)

- The Hybrid Annuity Model (HAM) is a good PPP framework to usher in the outcome-based financing. The model is based on projects being eventually financed by the government but over longer tenors. The private sector concessionaires finance the project at the beginning lowering the financing burden on the Government. It was highlighted that many states in India are now showing keen interest in the framework and adopting the model.

ON PROJECT FINANCE

- True, non-recourse, project finance is still a limitation within India. Many banks still insist on collaterals which in the case of public sector projects, where the land is largely owned by Government agencies, is going to be a problem. Banks have to and must move swiftly on the non or limited recourse lending. Whilst there are institutions like the India Infrastructure Finance Company Ltd (IIFCL) that do offer cash-flow based lending, a vast majority of lenders still press for a collateral guarantee which is going to be a serious limitation in deepening the project finance base in the country.

- In the absence of hard guarantees and collateral available, the projects should be designed so that a number of credit enhancement instruments are created, such as escrow accounts (as currently used in the HAM projects) and top-up tariffs that can enhance the credit rating of the project.

- It is important to bring lenders into the design of the project concession

agreement since they will end up financing nearly 70% of the project capital expenditure. Leaving them out at the early stage is a big mistake that ends up delaying project financial closures.

- Good quality projects will attract good quality funds. There is also a structuring mismatch between international lenders and Indian lenders. The international lenders are very comfortable with non-recourse, long-term concessionary financing, whereas Indian lenders struggle to do that. There is no dearth of development financing in India, but commercial international lending is not easily accessible, although the ECB (external commercial borrowing) route is open to borrowers. However, that is mostly for short tenor loans as compared to infrastructure sector that requires much longer tenors.

- Currency notwithstanding, the international lenders can act as a catalyst for financing as their IRR requirements would be lower than that of their Indian counterparts. The Indian Government could

INSURANCE BONDS

and catastrophe bonds offer increased resilience and protection against natural calamities such as flash floods and draughts

Blended Finance Approaches in the Water Sector and Innovative Financial Instruments

look at deepening the currency swap market that opens up a lot of foreign currency lending for the projects as it will take out the fix risk for the lenders.

- All lenders whether Indian or foreign need greater transparency into the projects. The challenge for lenders and investors in projects that are financed by urban local bodies, is to get a look into their financial capabilities. With the Central Government financier such as the NMCG, this is not a problem. The fact that all projects also have their own status portal which is public facing, is a huge plus and gives confidence to lenders.

- Other ways international development finance agencies can partner with India is to develop – first loss instruments, SME finance instruments, and technology adaptation instruments that will help in growing the market.

- Collectively the participants agreed that the water sector must be included in the priority lending segment of Reserve Bank of India. It is currently included in the infrastructure lending category for which the banks are already much over-exposed thus limiting the amount of liquidity they are making available for water sector projects.

- Insurance bonds and catastrophe bonds



offer increased resilience and protection against natural calamities such as flash floods and draughts. There are enough international precedents available in this area that must be explored in depth.

- Additionally, due to higher borrowing costs due to liquidity crisis within the banking sector in India, the project IRRs offered in the HAM projects must be closer to 14-15%. There is scope here for a blended finance approach, where public finance institutions' participating in the project can partake in providing liquidity over and above project finance through instruments such as bid bonds, performance guarantees and working capital limits.

ON DEVELOPMENT RISKS IN WATER SECTOR

- The development risks for private developers are still very high in all urban and municipal projects in India. In particular acquisition of land and provision of right of way remain massive issues.

When the project is initiated without the required land acquired, it invariably will lead to serious delays which then propagate through the project lifecycle putting the project under financial duress. It was noted that the Government agencies do recognize this risk and steps are being taken to have all project related approvals prior to bidding.

- The second major development risk is inadequate studies, data points and sub-standard DPRs (detailed project reports). It is surprising that despite India having such immense experience in the PPP sector, there is still inadequate funding for preparing quality DPRs, an area that all stakeholders agreed that it must be looked into. Other risk areas include delays in getting approvals and lack of force majeure clauses in the contractual agreement.

- One key concern that has been highlighted in the HAM project model is in areas where there is a significant

Blended Finance Approaches in the Water Sector and Innovative Financial Instruments

network component within the project. The lenders take a very grim view of the fact that they are financing a static asset which goes underground and for which they don't have recourse available.

- A critical remark was made with regards to mismatch between Government's expectations from developers and their attitudes during the asset construction and subsequently O&M (operations and maintenance) lifecycle. An opinion was shared that many of the developers were still in the EPC (engineering, procurement, construction) mindset, which is to get maximum returns during the construction phase of the project, whereas the project offers a steady annuity income stream over the entire project lifecycle. This is also the reason why many of the previous projects failed as they were ill-conceived in the commercial design phase. The contractor would construct the assets and move out, leaving the responsibility on to the ULB (urban local body).

- It was categorically highlighted that the previous issue will be fully addressed with the introduction of "outcome based" financing that shall align the delivery expectations of all parties in addition to harmonizing any variances.

- Participants were quite vocal on how the quality of project DPRs is a serious issue with contract bidders. There have been instances where there is a significant difference between the data stated in the DPR and the reality on the ground. It was highlighted that preparing the DPRs with meagre sums is the reason for this issue. But this is a major problem because errors in the DPR end up compounding massively in the project construction stages resulting in cost overruns and/or project delays.

- It was also stated that city administrators have to shift to a programmatic mindset so that they are able to prepare a proper audit of the city network, surface and sub-surface water resources which would help any consulting engineer preparing the DPR. One cannot expect



a consulting engineer to be parachuted into the city for a few weeks and get all the requisite data necessary for the DPR. That said, there are checks and balances introduced by verifying the DPR through a 3rd party independent agency which would highlight any factual errors and omissions.

- It was suggested that much like the energy sectors where they have certified energy auditors, the water sector should also introduce this concept of bringing in "certified water auditors".

- The concept of professional liability insurance that engineering consultant has to have in place is still very weak in India. If they are preparing a DPR for projects that runs in hundreds of crores or millions of dollars in capital expenditure on which investment decisions are made, then they should also be held liable for when things go wrong. The moment we bring that level of accountability into the system, then the overall quality improves.

- So, it is kind of a circular problem but is there a solution where certain data that

are prerequisite, that the government carves out a special fund that on these so-called underground assets which are so essential for the DPR that this knowledge is made publicly available and that such data are shared. There was a talk in the last two years on evidence-based policy making which should be followed through.

- Blended finance will certainly be applicable and the right instrument in creating quality DPRs where impact investors and Government agencies can join forces in bringing standards, increasing the quality of work done in preparation of the DPRs.

- An interesting point raised was that in absence of any precedence, Swiss challenge as a procurement policy construct is available when there is no capacity or no knowledge in the system. But the process must still go through parliamentary scrutiny. Similarly, for introducing new technologies into the market when there is no benchmark, the ETV (environment technology verification) framework that has been developed by cGanga and NMCG offers a pathway for technology proponents.



MUCH LIKE
the energy sectors where they have certified energy auditors, the water sector should also introduce this concept of bringing in "certified water auditors"

Blended Finance Approaches in the Water Sector and Innovative Financial Instruments



OUTCOME BASED
financing structures, if adopted properly, can add a lot of fillip to the water sector

Development of a Water Bond / Ganga Bond



THE development of a water bond is critical for both Government and private sector for being able to continually finance the projects. The Government requires municipalities and urban local bodies to tap into the bond markets to be able to finance the O&M. The private sector needs to tap into secondary markets to be able to free up capital for financing of subsequent projects. The release of equity or cheaper refinance of debt can be done through the secondary market mechanisms such as YieldCos, take-out-financing and asset purchases by institutional investors. This session was designed to focus on following aspects:

- How to structure a water bond and what does it entail
- Case studies on Municipal water bonds
- Case studies on private sector water bonds
- Models to develop secondary market structures such as YieldCos for water

KEY POINTS RAISED AND DEBATED

Greater effort needs to be made to develop instruments that match the asset/liability profile of the underlying projects. For instance, projects once commissioned stay on the balance sheet of the lenders, as there aren't enough take-out financing avenues available. Deepening of bond markets and secondary markets is very critical.

The corporate bond markets are very shallow in India and there is no real turnover since investors are holding the bonds until maturity. This is because the market-making mechanism which offers buy-sell prices is

non-existent. This deters new bond investors from entering.

Bond markets in India are only one-third the size of corporate loan market, whereas throughout the world it is the other way around. Thus, India must rapidly move towards strengthening the bond markets.

The secondary markets provide a great mechanism to both lenders and equity investors to recycle cash. As projects get built, the equity investors and lenders must find an exit. The equity investors can sell their assets on to the InvITs (Infrastructure

Development of a Water Bond /
Ganga Bond



investment trusts) or YieldCos. These vehicles provide steady, fixed income type returns to long term institutional investors such as pension and insurance funds. The lenders' debt can be swapped out by green bonds. In both cases long term capital takes over allowing the cash released to be redeployed into newer project pipeline.

World-over infrastructure projects are largely funded through the bond markets and the presence of take-out financing that allows deeper liquidity pools that match the asset-liability profile of the assets. So why should this not happen in India? A concerted effort needs to be made to establish the financing value chain.

Yield seeking investors are seeking good projects with good annuity profile. The hybrid

annuity model is a great start but these must also graduate on to a complete DFBO (design-finance-build-operate) framework where the entire risk is with the project developer. For that to happen it is imperative to bring more financing into the water sector.

Attracting more capital is very much a function of the price of water. Analysing other sectors such as power, gas, telecoms, roads, where there is a clear and healthy revenue stream finding capital is not a problem. Thus, by bringing in longer term funding at the revenue end also gives confidence to the construction finance institutions. Today NMCG is giving assurances that there are enough funds in its coffers to finance the various HAM projects. The truth is that the capital base is nowhere near enough to finance



THE HYBRID ANNUITY
model is a great start but these must also graduate on to a complete DFBO (design-finance-buildoperate) framework where the entire risk is with the project developer



all the projects in the entire river basin. Therefore, introduction of Ganga bonds, the proceeds of which will be used to offtake from the projects will massively expand the market. The investors will get signals from the Government that it is serious about deepening the market, and the Government will use multiplier effect of bringing in global investor base.

If the Central Government agency such as NMCG issues the bonds, it has to develop a revenue mechanism in order to pay back the principal and the interest. This should come from the municipalities and urban local bodies who will collect revenues through selling water. The ULBs are still

many years away from reducing the level of NRW (non-revenue water). But a 10 year headstart should be enough for these ULBs to increase their revenue streams. They could be incentivised with access to cheaper borrowing through the bond if they increased their revenue base.

However, there is one gross omission when addressing the credit rating of the municipalities, and that is they rely on a cash-based accounting system as opposed to an accrual based one. So, they do not have a balance sheet that reflects their true assets and liabilities. By switching on to an accrual-based system, the municipal bond market can transform in India.

India is slowly but surely moving towards deepening of secondary markets. Longer tenor paper is getting financed with the most recent one being a 27-year bond that got structured with a put/call option at the end of the 17-year period. Using the option, another 10 years was added to the paper.

Social bonds and impact bonds are also interesting instruments that can be deployed in the Ganga basin to incentivise behaviour change whether in industry or in agricultural sector.

The bond investors will look into the underlying credit rating of the vehicle they are financing. Quality of earnings

(revenue) is one area and so is the asset base. Justifying higher tariffs is easy in water stressed regions of western and southern India, but not so much in northern India. Behaviour shift in northern India has to be engineered through the right governance and policy construct.

A critical challenge is that all the load of water tariff comes onto urban and industrial sector. One major actor missing is the agricultural sector that is also the largest consumer of water. So, unless we address this major mismatch, market failure will remain the stark reality within the water sector.

Innovative Financial Instruments Developed for the Water Sector - Fintech & Digital Solutions

IN this session various Fintech based instruments developed or being developed in the water sector were presented.

- Water quality trading
- Agricultural insurance through digital platforms
- Waste commodity trading exchange

KEY POINTS RAISED AND DEBATED

Some very interesting fintech solutions are being developed around the world that address market failures in the water, wastewater and waste management sectors.

Many of these solutions are underpinned with the blockchain technology that bring in the necessary trust factor into equation. However,

blockchain only addresses a small component of the issue. The larger challenge of market failure, lack of commercial models etc. are to be solved by developing a holistic framework with the backing and involvement of all key stakeholders.

SOLUTION 1: WATER QUALITY TRADING

- Water quality trading scheme is a mechanism to encourage bulk water

users to recycle and reuse wastewater. The scheme works well if the region is water stressed such as those in western and southern India. The policy support needed to establish this scheme is one that puts a high value to fresh water extraction. For instance, if fresh-water costs Rs 100 per cum then grade-5 level recycled water, which can be recovered for between Rs 50-75 per cum, will become a lot more affordable to the industry.

- In order to accelerate the introduction of Circular Economy principles, the waste-water industry stakeholders must adopt market based financial instruments. There are enough precedents available from other sectors where such instruments

have been developed and adopted to internalise the cost of environmental damage. Examples include renewable energy generation through carbon credits/certificates that incentivise energy producers to generate more renewable energy and polluters to buy into credits to offset their emissions. Energy efficiency sector encourages better practices and introduction of technology so that benefits are derived through efficiency as opposed to production.

- A trading platform can be created through a closed loop mechanism, which is the only way it is likely to work in the water sector. Industries who achieve efficiency or recycling targets can generate certificates which must be



Innovative Financial Instruments Developed for the Water Sector - Fintech & Digital Solutions

bought by under-achievers or excessive polluters to compensate for their water use inefficiencies.

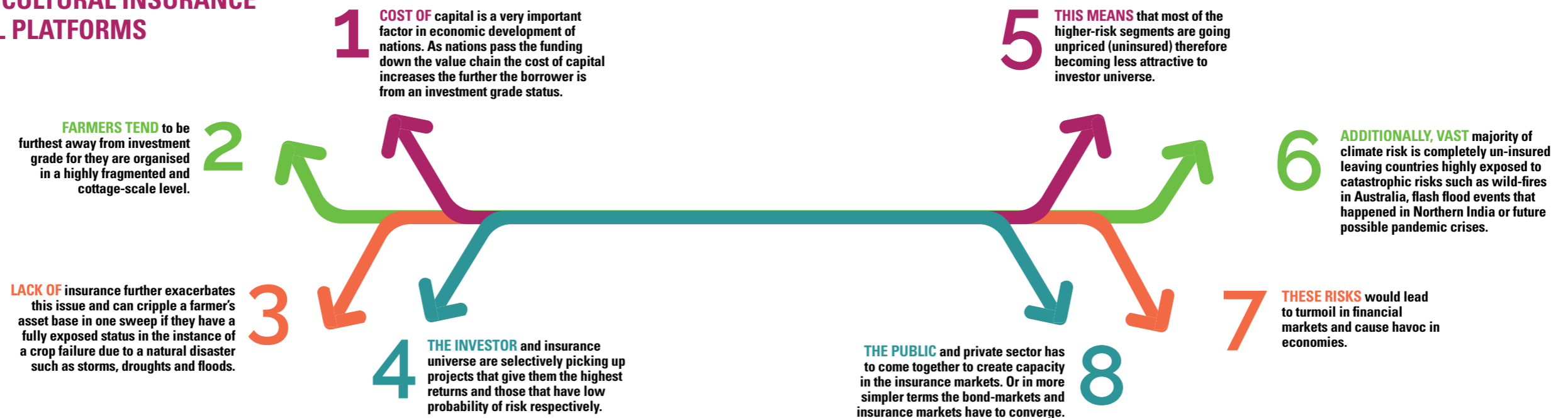
- The treated water can be securitized through creation of a wastewater reuse certificate which can be commercially traded like any other commodity security.
- Creating an enabling environment requires strong regulatory support particularly from the State Pollution Control Boards (SPCBs) as they require all industries to install IT infrastructure that provides real-time and/or offline data for monitoring. However, until now the PCBs are not monitoring the data on a regular basis.
- Once the over-arching framework is available, creation of local area water markets will deliver the necessary

market-participants needed to activate the trading schemes.

- Trading can happen between a number of market participants: industry-industry, industry-urban local body, industry-agricultural, commercial-urban local body, etc.
- The technology needed to support such schemes is already developed such as Internet-of-Things for real-time data generation and data analytic tools for enabling the price discovery. Block-chain can bring in the requisite trust factor for all commercial participants.
- The regulators will need to support the market all the way through, particularly in ensuring that the obligors are complying with purchasing the certificates, because if they don't, the trading mechanism



SOLUTION 2: AGRICULTURAL INSURANCE THROUGH DIGITAL PLATFORMS





THE LARGER CHALLENGE

of market failure, lack of commercial models etc. are to be solved by developing a holistic framework with the backing and involvement of all key stakeholders

will collapse. This happened during the Renewable Purchase Obligations (RPOs) that was mandated of the States by Central Government. However, the States were not penalized in the case of non-compliance which brought the market to a grinding halt.

SOLUTION 3: WASTE COMMODITY TRADING EXCHANGE

- The financing community has started to look seriously into developing market instruments for wastewater and solid waste.
- Managing waste is at the centre of circular economy principles. The problem of a dysfunctional circular economy is on two fronts (a) Either there isn't a regulatory framework to support greater reuse or recycling or (b) the waste generation is too fragmented and costly to collect and recycle. Both situations lead to industry using primary material sources.
- A new approach promises to address the latter issue. Much like local area water markets, creation of local area waste markets can energise the value chains in place.
- Take for instance plastic littered on the streets. Vast majority of the plastics that is recyclable does get collected and pushed to the large recycling companies. However, there is enough plastics such as the multi-layered-plastic (MLP) used in bags of chips etc., that doesn't get collected. This is because MLP cannot be recycled. It can be incinerated which will be both commercially expensive to transport and environmentally

harmful, rendering that option as a non-starter. There are technologies out there that can use MLP and generate fuel out of it with no harmful emissions. However, to finance those technologies requires assurance of waste supply, which is difficult to organise. So, if there is a commodity value accorded to the waste and value chain clearly visible, then the market will self-organise itself.

- The commodity trading exchange platform works on two-levels (1) the physical collection and storage layer and (2) securitised investment/trading on a marketplace. This market will function very much like other commodity exchanges such as gold, metals and agri-produce.
- The market-place needs to fulfil three underlying conditions to function successfully:
 - The collectors must get paid a spot payment, so someone must come in the middle to offer them immediate payment.
 - There must be decentralised warehousing facility which can generate a block-chain based receipt which acts as a financial instrument. Off-takers of the waste can procure directly from the warehouse through spot or long-term contracts. This function makes the commodity valuable and therefore worth investing in.
 - The commodity investors can buy and trade the instrument leading to market price-discovery.

TRACK



TECHNOLOGY & INNOVATION SHOWCASE

THEMES

- Decentralised Wastewater Infrastructure
- Creating Wetlands and Integration of Bio-remediation with Traditional STPs
- Solid Waste and Plastics Management
- Resource Recovery and Water Efficiency
- IoT, Remote Sensing, Data Generation
- Artificial Intelligence and Data Analytics in the Water Sector

DAY 2:

Friday; December 6, 2019
14:00 – 15:30 h, 16:00 – 17:30 h

DAY 3:

Saturday; December 7, 2019
10:00 – 11:30 h, 12:00 – 13:30 h

VENUE:

Hall 4, Vigyan Bhawan,
New Delhi

CHAIR:

M Jawed [cGanga, IITG]

MODERATOR:

Sundeep Chauhan [Expert, cGanga, IITK]

LEAD DISCUSSANTS:

Aviral Saxena [Solid Waste Management
Expert, State Mission for Clean Ganga]
Brijesh Sikka [Senior Consultant, NMCG]
B Sengupta [Ex Member Secretary, CPCB]
K Sri Harsha [Director, Kritsnam Technologies]
Manish Jain [Partner, Envint]
Saumyasib Mukhopadhyay [Manager, NMCG]
Venkatesh Dutta [Associate Professor,
BBAU, Lucknow]

Decentralized Wastewater Infrastructure

Creating Wetlands and Integration of Bioremediation with Traditional STPs

Ganapathy Ganeshan, Director of Programs
(Consortium for DEWATS Dissemination Society, India)



FEATURE

A non-profit society focused on pollution mitigation, wastewater treatment, fecal sludge management, water-body rejuvenation and solid waste management. As an example, rejuvenated the Mahadevpura Lake in Bangalore city by municipal wastewater treated through a combination of anaerobic treatment processes and floating wetlands. Hence,

both the O&M skills needed and operating costs (about Rs 1.0 to 1.25/KL) are low, and the project also improved the microclimate, aesthetics and groundwater recharge.

INNOVATION'S ADVANTAGES

Energy-efficient, holistic and resilient ways of treating urban wastewater to recharge and revive waterbodies that also connects with citizens and helps them take ownership.

CRITICAL OBSERVATIONS

Though the project was executed for a relatively small lake in Bangalore, the technology seems scalable. But sludge accumulation may be a problem after one or two years of operation. Moreover, removal of heavy metals and process efficiency for dilute sewage need to be checked. The Team cGanga may further review the technologies presented as a part of the ETV programme or otherwise as and when a demonstration plant is put up in India.

Decentralized Wastewater Infrastructure
Creating Wetlands and Integration of
Bioremediation with Traditional STPs

Arun Kumar, Country Manager (GV Soluciones, Spain)



FEATURE

Decentralized and remotely operated effluent treatment, sewage treatment and smart drinking water solutions for better water use efficiency. Products include a compact and economic treatment plant for slaughterhouse industry and a drinking water plant that can be remotely controlled and monitored.

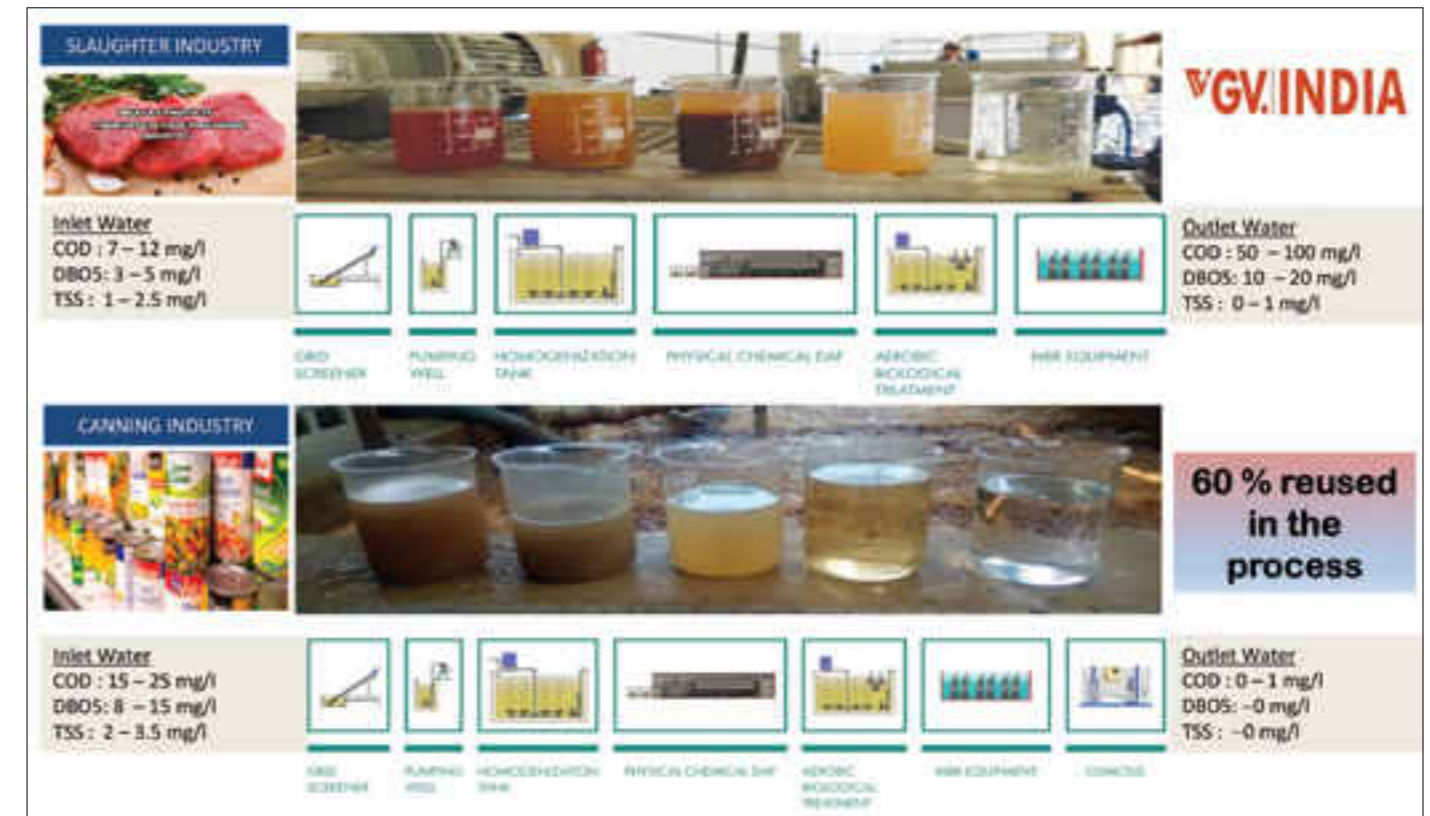
INNOVATION'S ADVANTAGES

Ensures reliable wastewater

treatment and optimized technology combinations with remote operation & monitoring facilities.

CRITICAL OBSERVATIONS

It is not very clear what kind of water the GV Solutions technology handles or produces. The Team cGanga may further review the technologies presented as a part of the ETV programme or otherwise as and when a demonstration plant is put up in India.



Decentralized Wastewater Infrastructure
Creating Wetlands and Integration of
Bioremediation with Traditional STPs

CS Pradeep Kumar, Chief Executive Officer (Bio Starts Ventures, in collaboration with Biosfera Foundation, Netherlands)



FEATURE

Developed bioengineering technology by using natural materials – natural fibers, plants, bacteria and natural substrates for bioremediation, phytoremediation, and bio soil stabilization, with low-carbon engineering, and little or no energy requirement.

INNOVATION'S ADVANTAGES

Safe, trouble-free and effective wastewater treatment using natural bio-materials for rejuvenation of waterways and water bodies.

CRITICAL OBSERVATIONS

The canal improvement project by BSV in West Bengal indicates marked improvement in the ambience of the canals. But whether the improvement is satisfactory and cost effective remains to be verified.



Decentralized Wastewater Infrastructure
Creating Wetlands and Integration of
Bioremediation with Traditional STPs

Anil Pillai, Vice President - Technology (BioXgreen Technology, India)



FEATURE

Patented bioremediation technology using a pure culture microbial consortium (non-toxic) for stabilization of waste and eventual mineralization with concurrent reduction in BOD and BNR, and a patented thermal alkaline process for sludge or bio-solids management.

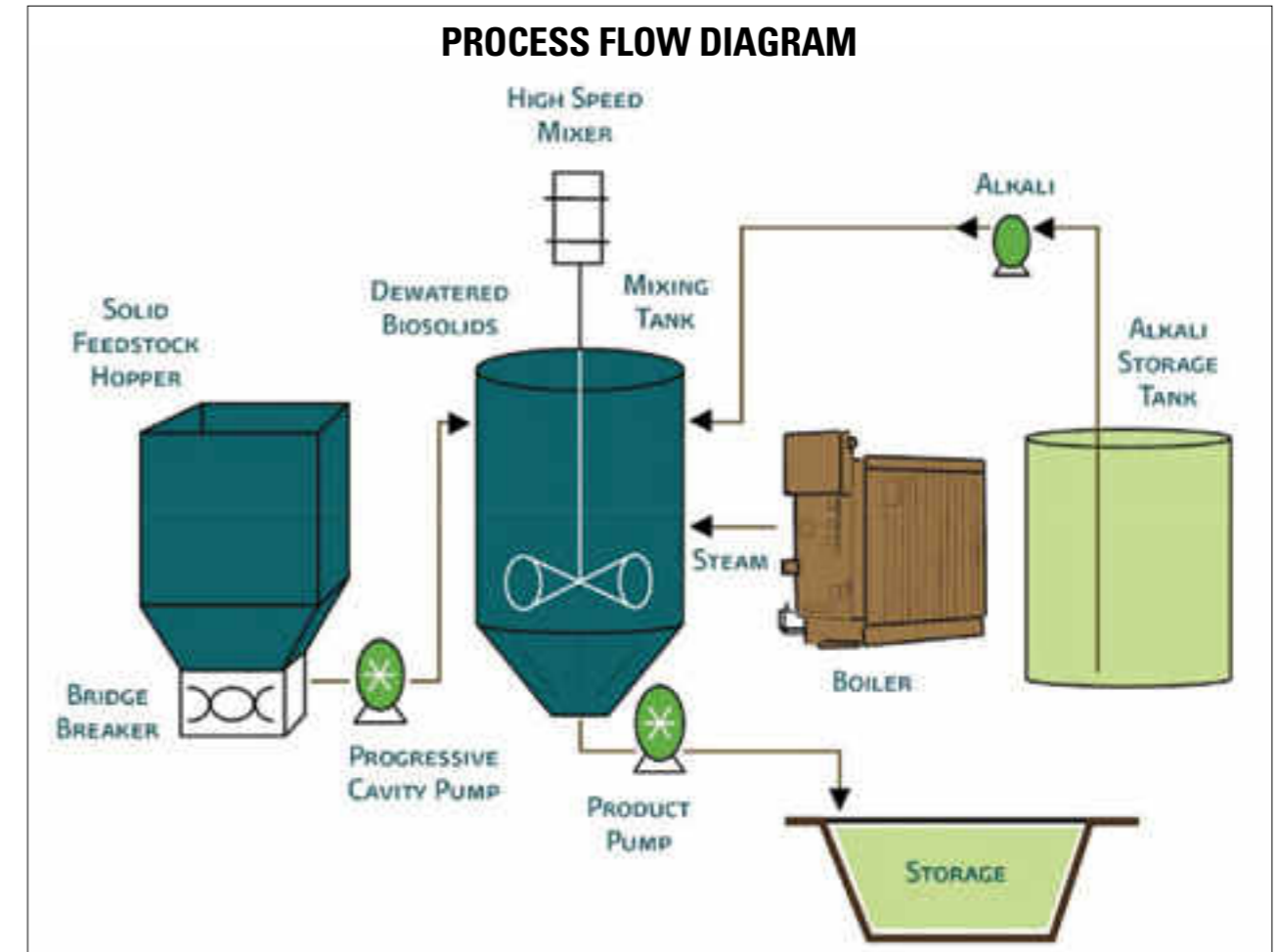
INNOVATION'S ADVANTAGES

Safe and eco-friendly bioremediation

process using microbial cultures that have easy in-situ application without major structural change or capex.

CRITICAL OBSERVATIONS

Bacterial dosage amounts, dosage control, and OPEX are some issues needing verification and, hence, further interaction is needed. The Team cGanga may further review the technologies presented as a part of the ETV programme or otherwise.



BIO-REMEDIATION OF 60 MLD STP AT RAJAPUR, ALLAHABAD (RECEIVING 95 TO 100 MLD SEWAGE), UTTAR PRADESH, INDIA

PARAMETERS	60 MLD STP
Average flow per day expected (MLD)	70-74
Actual flow recorded (MLD)	85-98
Inlet BOD mg/L	130-174
Outlet BOD mg/L	12 - 18
Foaming after treatment	Eliminated
Odour after treatment	Eliminated

Decentralized Wastewater Infrastructure Creating Wetlands and Integration of Bioremediation with Traditional STPs



Decentralized Wastewater Infrastructure Creating Wetlands and Integration of Bioremediation with Traditional STPs



Solid Waste and Plastics Management

Rajesh Jain, Managing Director (Enhanced Wapp Systems, India)



FEATURE

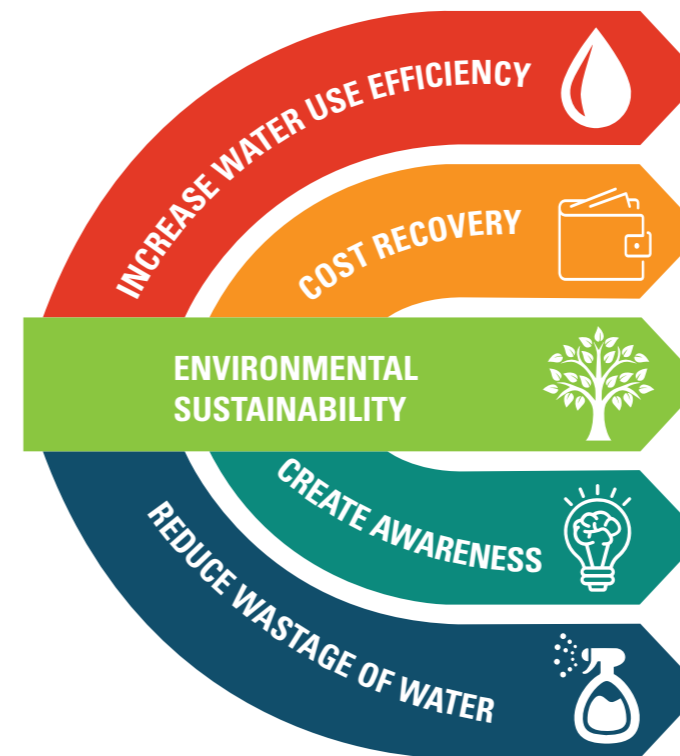
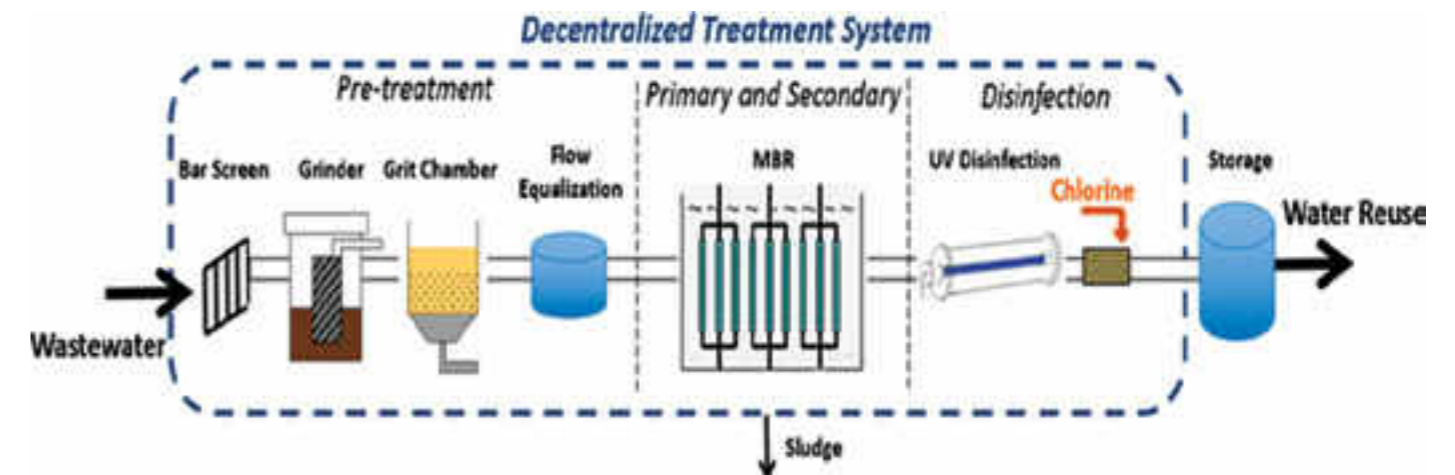
Decentralized wastewater recycling and water audits for buildings and commercial complexes to minimize losses and reduce water demand for cities to achieve sustainable water management conditional upon water pricing.

INNOVATION'S ADVANTAGES

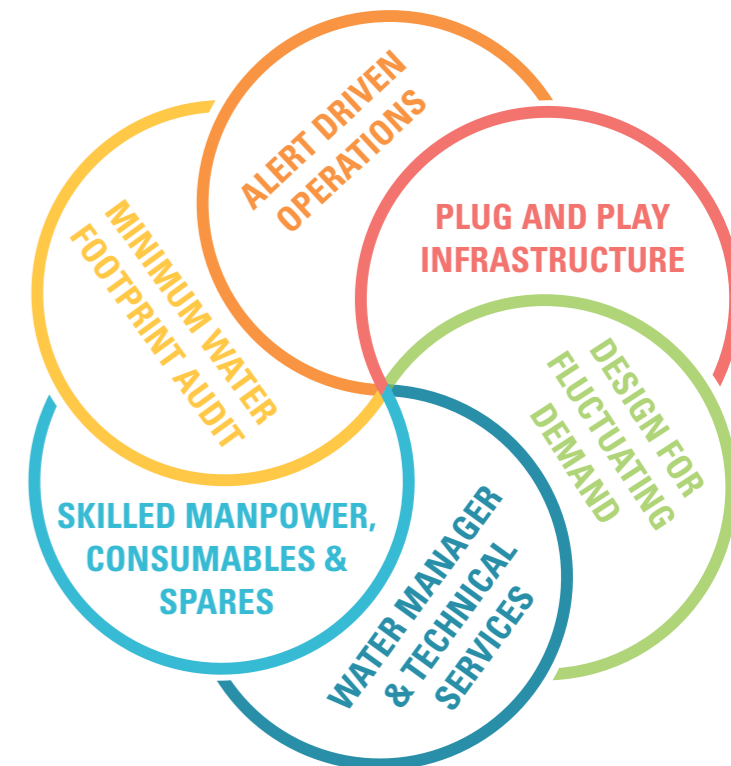
Measurable/ quantifiable procedures for water savings and sustainable water management in urban India.

CRITICAL OBSERVATIONS

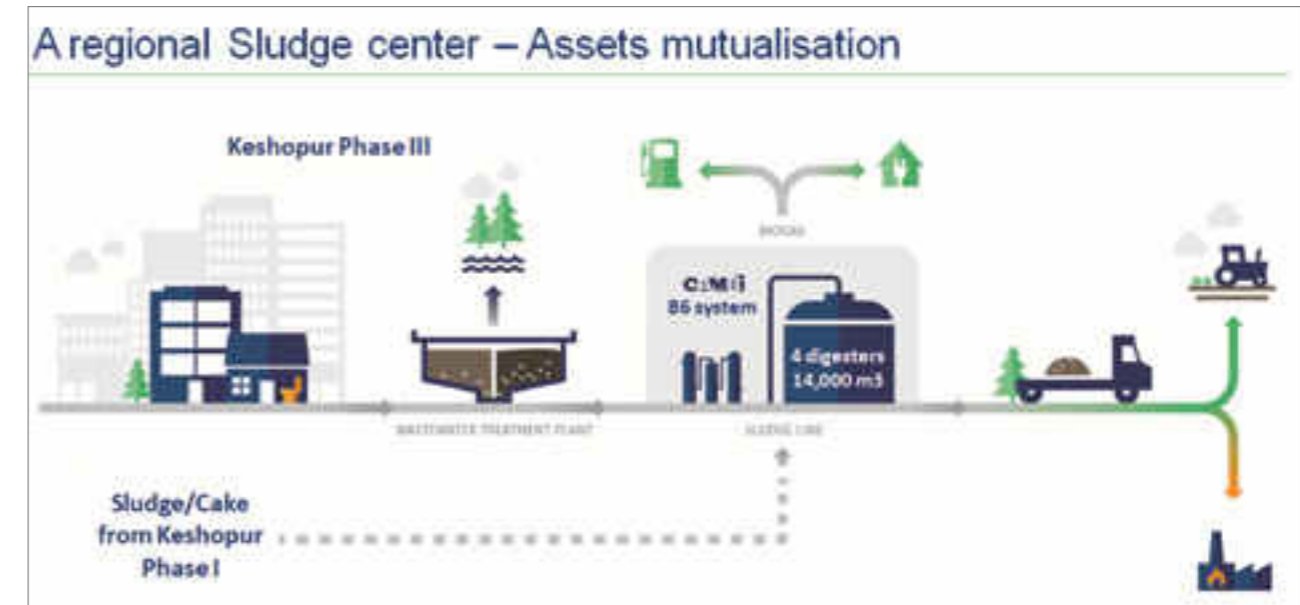
The presentation seems to concern advocacy rather than technology.



TOTAL WATER MANAGEMENT



Morten Hegge, Regional Director (CAMBI, Norway)



FEATURE

High-energy generating and compact sludge digesters with nutrient-rich bio-fertilizer production.

INNOVATION'S ADVANTAGES

Internationally proven technology ideal for energy-starved and land-scarce urban India.

CRITICAL OBSERVATIONS

It is an established technology, but some type of demonstration needs to be put for the ETV system taking into consideration the importance of water footprint, carbon footprint and other footprints. The Team cGanga may further review the technology presented as a part of the ETV programme or otherwise as and when a demonstration plant is put up in India.

Kenneth William Jones, Director (Exo-Cubic Solutions, UK)

**FEATURE**

Clean technology applications for polymer recovery and reuse, specifically from scrap tyres, using water washing with recycling.

INNOVATION'S ADVANTAGES

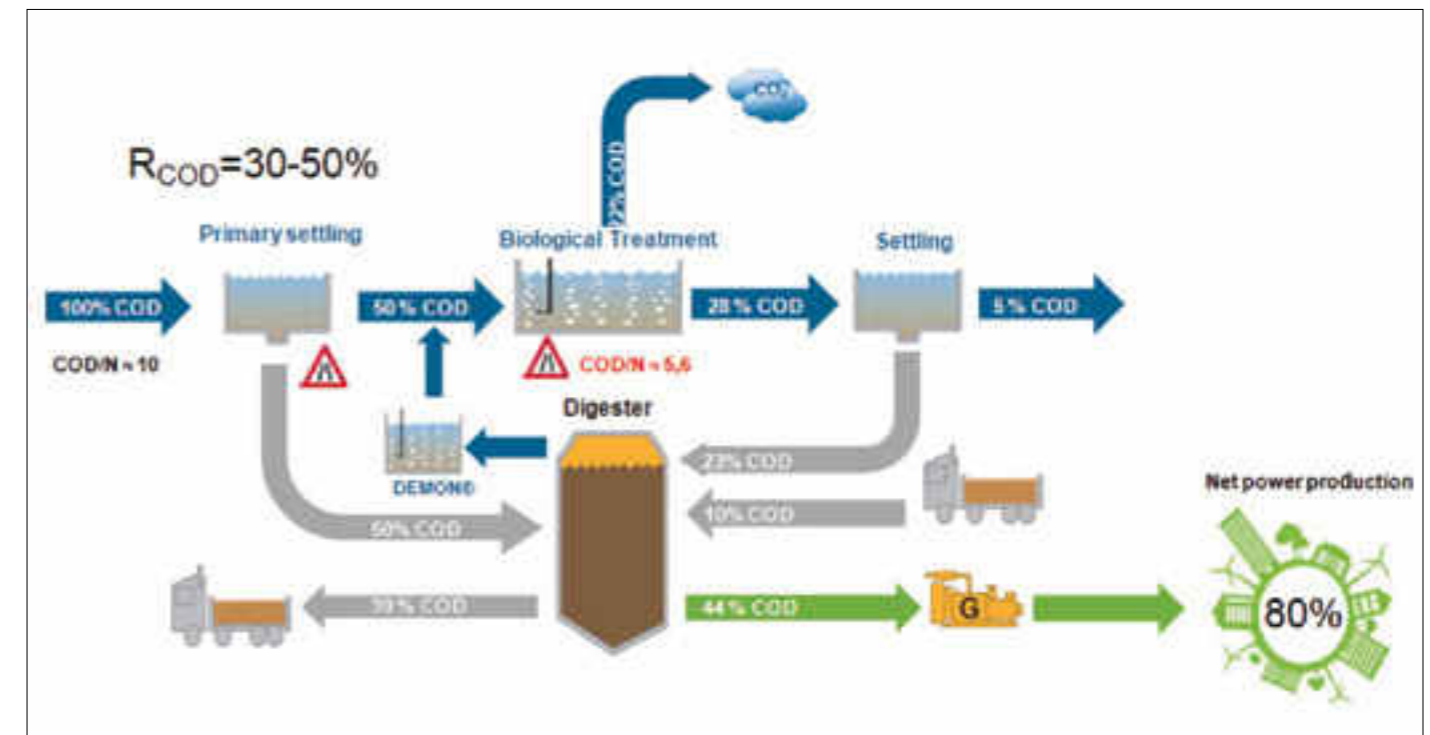
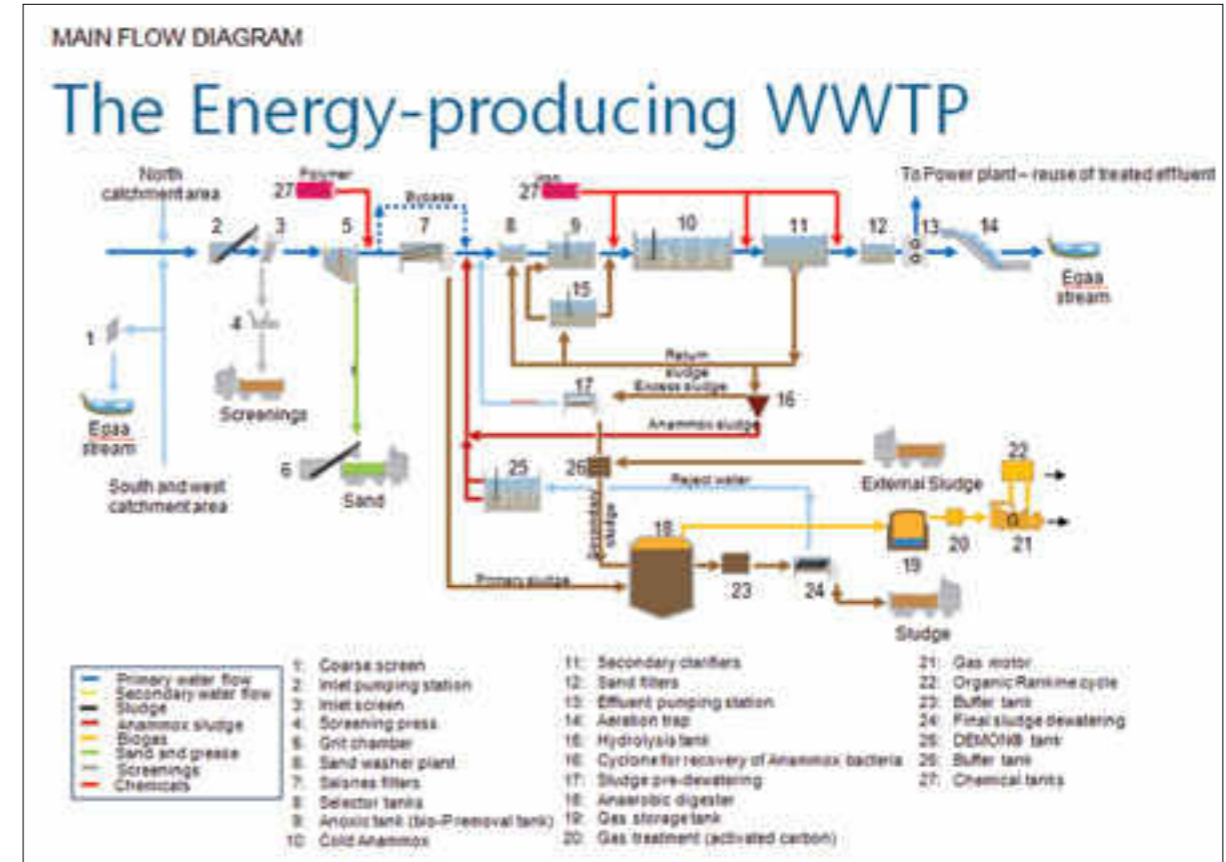
Eco-friendly and safe process that prevents leaching of heavy metals from

the millions of tons of scrap tyres dumped in landfills.

CRITICAL OBSERVATIONS

More such plants are desirable in India. The Team cGanga may further interact and provide support as a part of the ETV programme or otherwise as and when the presenters are ready for demonstration in India.

Maiken Bjørn Madsen, Project Manager (Aarhus Vand, Denmark)



FEATURE

Energy-Sufficient Sewage Treatment Plants with efficient mesophilic sludge digestors for superior energy generation and fertilizer production.

INNOVATION'S ADVANTAGES

Proven technology with energy-efficient sewage and sludge treatment generating organic fertilizers.

CRITICAL OBSERVATIONS

Concerns about pesticide, pharmaceutical and micro-plastic residues in the sludge need to be looked into for use of the sludge as bio-fertilizer. The Team cGanga may further review the technologies presented as a part of the ETV programme or otherwise.

Aditya Sharma, Senior VP, Asia (Boson Energy, Luxembourg)



FEATURE

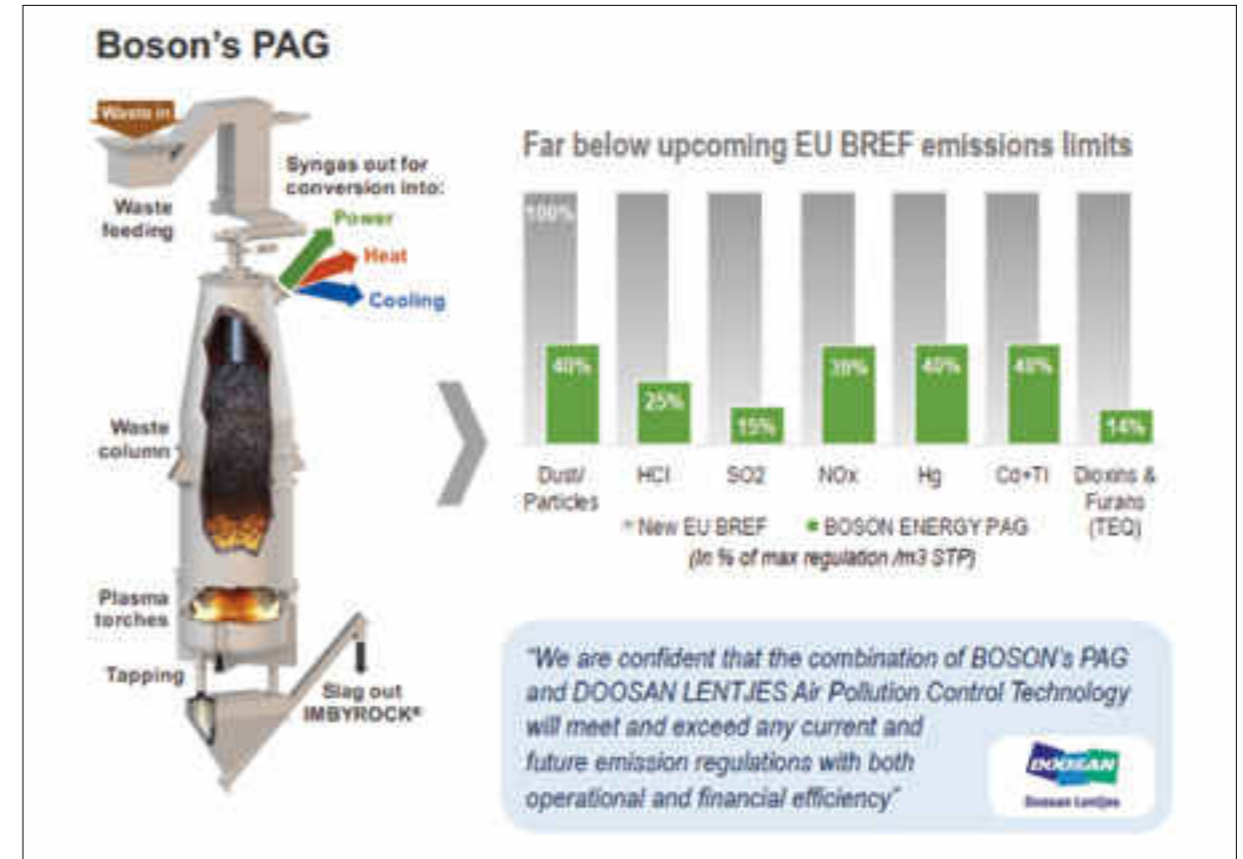
Gasification of solid and semi solid municipal wastes at 1200-1400 °C producing value-added vitrified slag, electricity and thermal energy (about 2 kW/kg of MSW) with no ash generation as in incineration.

INNOVATION'S ADVANTAGES

Clean technology for solid waste to value-added slag and energy generation with no emissions or solid waste generation.

CRITICAL OBSERVATIONS

Boson Energy's demonstration plant coming up in India will be evaluated through the ETV mechanism.



Rajesh Mittal, Director (Last Mile Energy Solutions, India)



Plastic waste collection center in Rohtak, Haryana



FEATURE

Comprehensive plastic waste management to recover oil, energy and other value-added products from segregated plastic wastes collected in distributed plastic collection centers instead of inefficient use in incinerators, brick kilns and power plants.

INNOVATION'S ADVANTAGES

Environmentally sound and efficient

value recovery from harmful plastic wastes.

CRITICAL OBSERVATIONS

There is a need to check the technology's suitability in Indian conditions. The Team cGanga may further review the technologies presented as a part of the ETV programme or otherwise as and when a demonstration plant is set-up in India.

Solid Waste and Plastics Management



Solid Waste and Plastics Management



Resource Recovery and Water Efficiency

Nick Bartlett, Director (Blue Sky Bio, UK)



FEATURE

For sewage sludge, beer waste, etc. maximizing energy production with 90% breakdown by a multistage fermentation process – waste solubilization, hydrolysis, methanogenic fermentation, hydrogen production in photo-reactors, and micro-algae growth in photo reactors with struvite production.

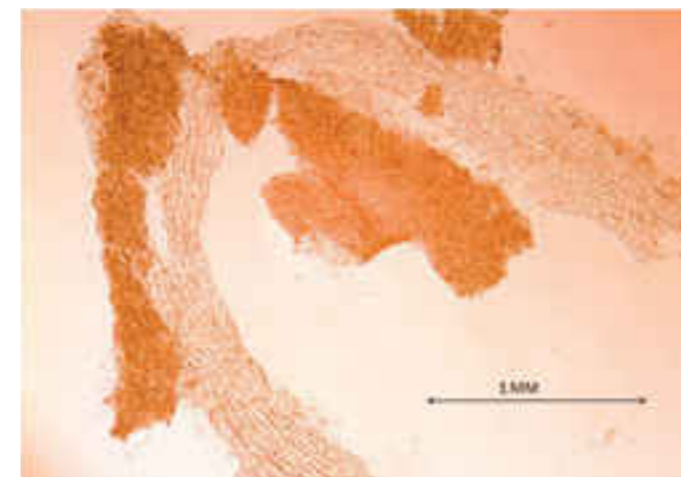
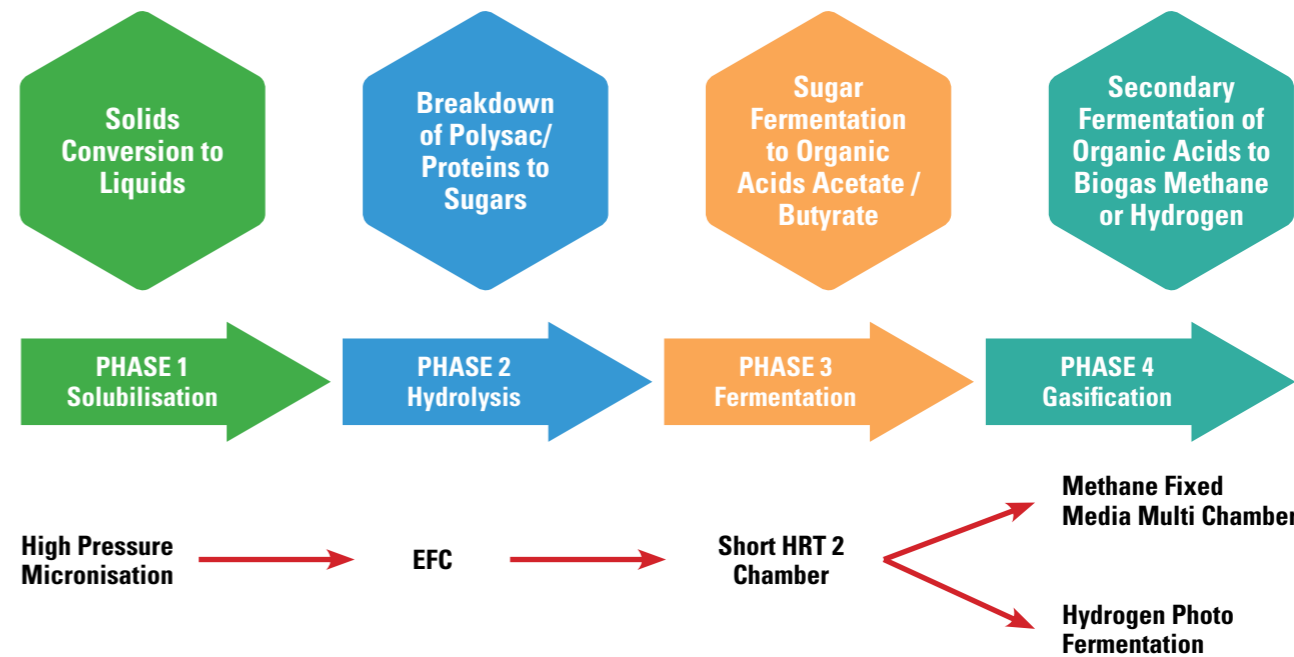
INNOVATION'S ADVANTAGES

Highly optimized multi-pronged process for all-round value extraction from organic sludge wastes.

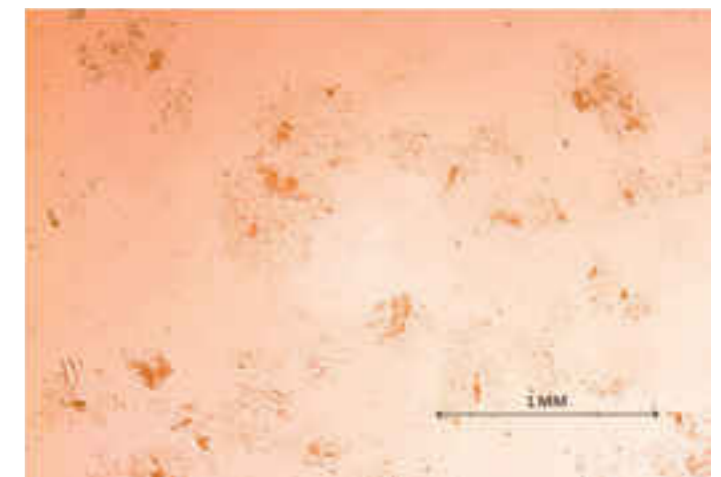
CRITICAL OBSERVATIONS

The technology is still in developmental process. Once the demo plant comes up in India, its robustness, relevance and economics in Indian conditions will be looked into.

STAGE OF HYGEN BIO REACTOR (HBR) LINE



SEAWEED BEFORE TREATMENT



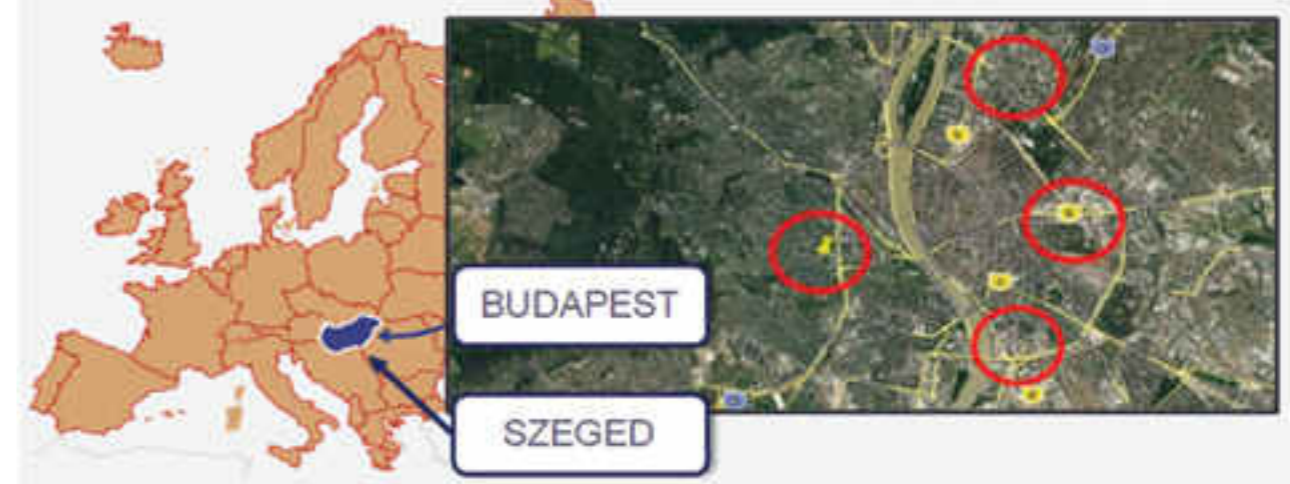
SEAWEED AFTER TREATMENT AT 500 BAR

KELE Sándor Zsolt, Development Director
(Thermo Watt, Hungary)



ACTIVE REFERENCE PROJECTS

- MOM CULTURAL CENTRE (8,600 m², 1 MW)
- BUDAPEST SEWAGE WORKS PREMISES – OFFICES & WAREHOUSE (9,000 m², 1MW)
- MH EK MILITARY HOSPITAL (40,000 m², 600 LITS, 3,8 MW)
- UNIVERSITY OF SZEGED (25,000 m², 1.4 MW)
- BUDAPEST SEWAGE WORKS PREMISES – FERENCVAROS (16,000 m², 1.2 MW)



FEATURE

Energy from wastewater for heating and cooling purposes with zero emission of CO₂ using a specially designed heat exchanger, capable of producing about 1 MW energy per 120 cumecs per hour wastewater with only about 4-5% operational cost.

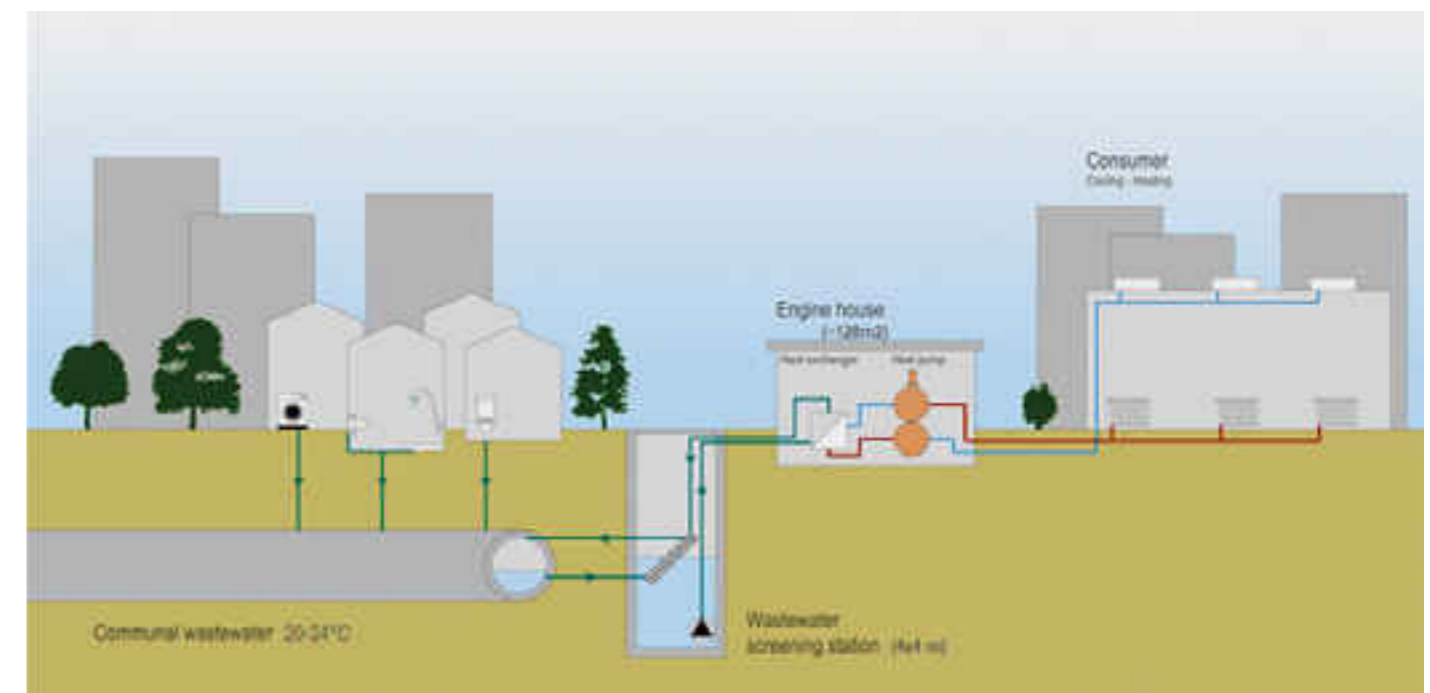
INNOVATION'S ADVANTAGES

Highly innovative use of wastewater energy especially suited for urban

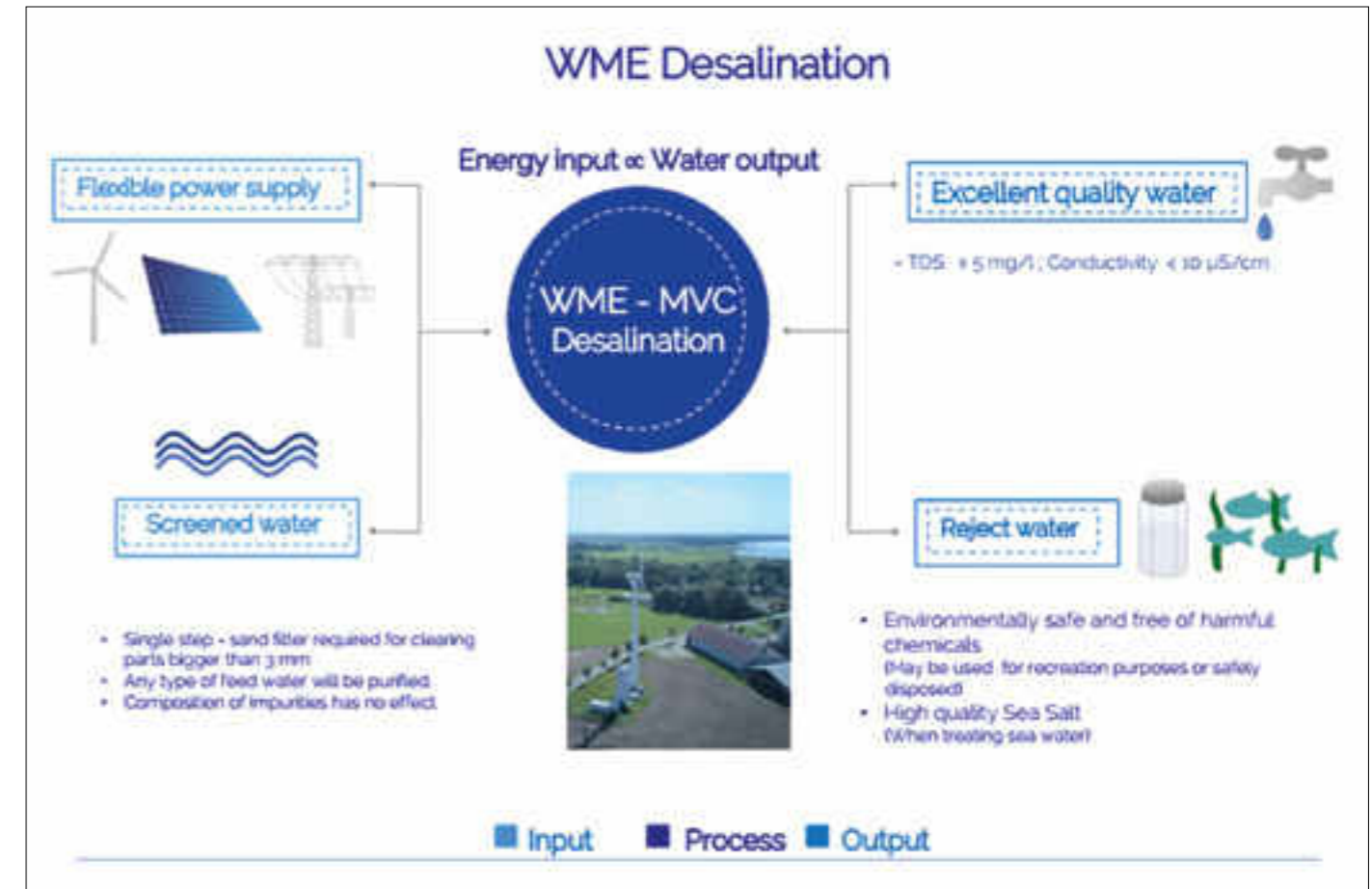
conglomerates and remote locations without local energy sources.

CRITICAL OBSERVATIONS

The economics and benefits of the technology seem to be promising and can help municipalities generate additional revenue from municipal wastewaters. The Team cGanga may further review the technologies presented as a part of the ETV programme or otherwise as and when a demonstration plant is put up in India.



Amogh Sharma, Project Manager (WME, Germany)



FEATURE

Eco-friendly, compact and fully automated sea water desalination plants based on mechanical vapor compression technology in a single step process that can work round the year with minimal operational manpower and any type of energy input, and with edible salt produced from the reject water.

INNOVATION'S ADVANTAGES

Very promising technology for water purification and resource extraction from

high-TDS water as well as contaminant removal.

CRITICAL OBSERVATIONS

The electro-dialysis process may not remove dissolved organics by itself, i.e. without some additives, but the additional benefits of recovering lithium and, possibly, cobalt are promising. The Team cGanga may further review the technologies presented as a part of the ETV programme or otherwise.



Girish Kanole, Consultant (Rivulis Irrigation, India)



FEATURE

Software-based application of real-time satellite data to assess and communicate crop optimal irrigation needs for farming areas of about 1 hectare or more through smartphone apps based on proven technology.

INNOVATION'S ADVANTAGES

Potentially very useful and economic for small and medium farmers for hugely water-saving irrigation of a variety of crops and crop seasons.

CRITICAL OBSERVATIONS

Spatial accuracy of satellite based data may be a limitation in predicting irrigation requirements accurately as compared to drone survey data, although the costs of satellite data may be much less. Actual savings in water use and fertilizer use also need to be looked into. The Team cGanga may further review as a part of the ETV programme or otherwise.

How it Works

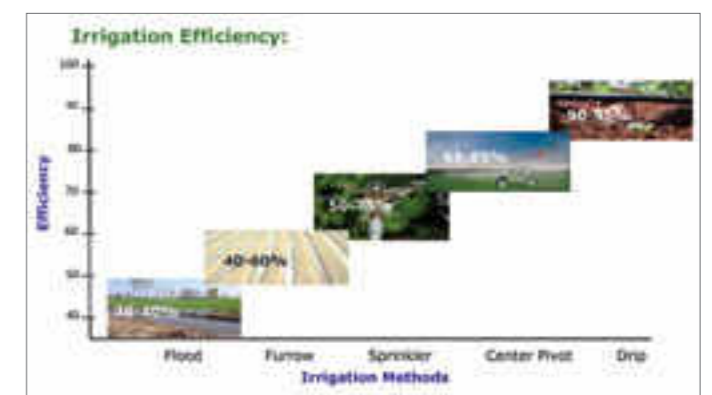


What We Do

Provide a sensor-free, site specific, dynamic irrigation recommendations using Latest Remote sensing Technology

- Each Grower Can access or use technology from any where, any time through
- Web Top or Mobile Application
- Mobile Application

For Indian Farmers, Manna has developed User Friendly Mobile App





IoT, Remote Sensing, Data Generation

Artificial Intelligence and Data Snalytics in the Water Sector

Bhushan Patil, Sales Manager (Trojan UV, India)



FEATURE

Efficient and finely-tuned UV disinfection of water and/or treated wastewater depending on required output coliform levels and other parameters for municipal, industrial and commercial uses.

INNOVATION'S ADVANTAGES

Scientifically grounded approach

to disinfection of water and treated wastewater.

CRITICAL OBSERVATIONS

Trojan UV is already a part of the ETV with working technology and proven data. A SWOT analysis of their method relative to other disinfection technologies like chlorination will be useful.

Location:
Belmont Wastewater Treatment Plant
Indianapolis, Indiana

Product:
TrojanUV3000Plus™

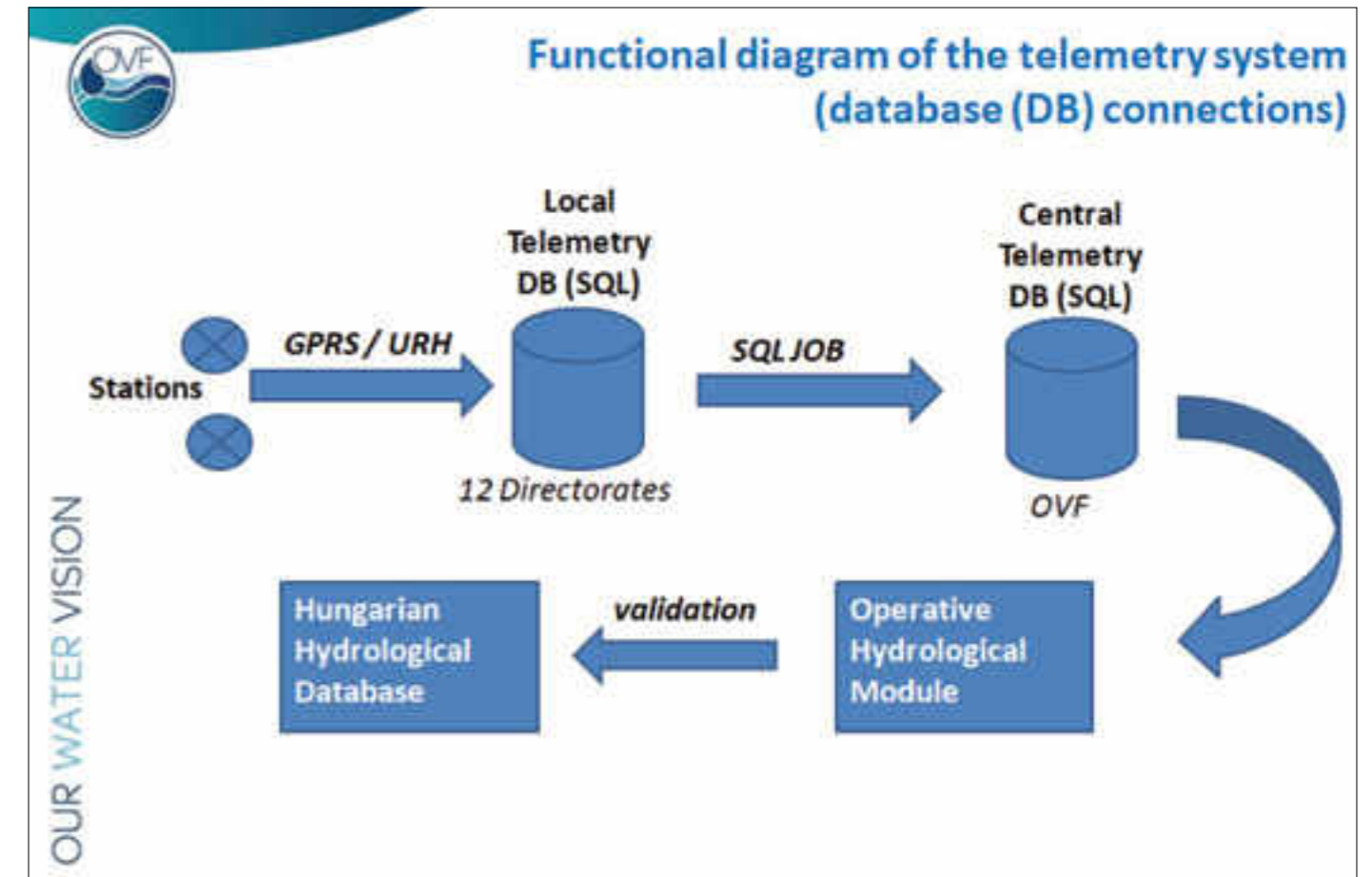
Application:
Wastewater Disinfection

Statistics:

- System Overview: 7 channels, 14 banks, 24 modules per bank
- Peak Flow Capacity: 170 MGD
- UVT: 55%
- TSS: 30 mg/L maximum
- Disinfection Limit: 235 E. coli/100mL; single-day maximum



Jeno Labdy, Technical Deputy Director-General (General Directorate of Water Management, Hungary)



FEATURE

An innovative integrated hydrological monitoring network for software-based drought and/ or flood forecasts with ground data telemetry and multiple checks and balances.

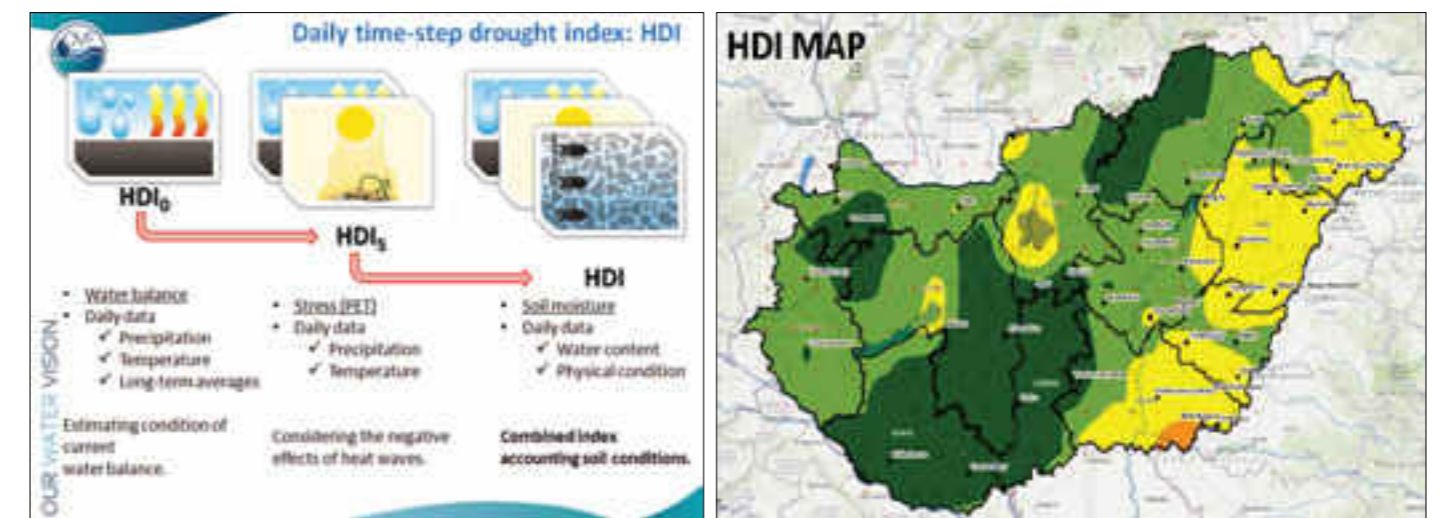
INNOVATION'S ADVANTAGES

Significant hydrological forecast applicability

potential in India even with limited and varied ground-level data.

CRITICAL OBSERVATIONS

Such global technological advances are welcome to India as they will find useful applications and generate demand for high resolution satellite data which are already being generated by the Indian Government but are not available in public domain.



IoT, Remote Sensing, Data Generation Artificial Intelligence and Data Analytics in the Water Sector



IoT, Remote Sensing, Data Generation
Artificial Intelligence and Data Analytics
in the Water Sector



TRACK

D

THEMES

- **Presentations on Global Best Practices and Experiences Nashik, Faridabad, Indore, Singapore and Varanasi**

DAY 2:

Friday, December 6, 2019
14:00 – 15:30 h, 16:00 – 17:30 h

DAY 3:

Saturday, December 7, 2019
10:00 – 11:30 h, 12:00 – 13:30 h

VENUE:

Hall 5, Vigyan Bhawan,
New Delhi

CHAIR:

G Asok Kumar [Mission Director, National Water Mission & ED (P), NMCG]
SK Ratho [DDG, NMCG]

MODERATORS:

R Bhattarai [cGanga, IIT K]
Subrata Hait [cGanga, IIT P]

LEAD DISCUSSANTS:

Ajay Pradhan [CEO, Cetus Consulting Solution Services Pvt. Ltd., New Delhi]
Ashish Mathur [Grant Thornton India LLP]
MS Mohan Kumar [IISc Bangalore]
PS Rana [Construction Industry Development Council (CIDC)]
Suresh Kumar Sharma [Sadhan Engineers Pvt. Ltd., New Delhi]

WATER IMPACT IN SMART CITIES AS INTEGRAL PART OF RIVER RESTORATION AND CONSERVATION STRATEGY



Water Impact in Smart Cities as Integral Part of River Restoration and Conservation Strategy

PROBING THOUGHTS

THE term “Smart City” immediately brings to mind a city that makes extensive use of information technology and primarily electronic sensors linked with the internet (internet of things or IOT) to collect important information, analyze the collected data to generate meaningful knowledge and actionable tasks for optimizing the city’s services and operations. However, when used with the city’s water-related services, simply having the information technology and IOT and performing data analyses alone aren’t enough, we must make smart choices about the water domain: choosing the most appropriate, robust, sustainable and resilient solutions, considering the unintended consequences of our choices, and making the appropriate and effective design, operation and maintenance decisions. To accomplish

that, we need a deeper understanding of the water sector so we know what the important parameters to be measured and analyzed are, leading to better services at a lower cost while maximizing the public health and environmental benefits.

A paradigm shift is needed in managing water in the urban sector. Traditional approaches use point source water supply and treatment facilities. However, with most cities getting water stressed, every waterbody in the city must be seen as a supply source and/or a part of the water resources system framework.

The four sessions in Track D featured five smart cities (four Indian and one international) presenting their case studies about water impact in their smart cities as integral part of river restoration and conservation strategy.

A PARADIGM SHIFT

is needed in managing water in the urban sector. Traditional approaches use point source water supply and treatment facilities. However, with most cities getting water stressed, every waterbody in the city must be seen as a supply source and/ or a part of the water resources system framework



The aim was to understand through individual case studies the global effective practices and experiences, learn about critical points of failure and strategic solutions that can be applied in the Indian context. Specifically, this track’s aim was to explore the following questions:

- How are cities creating new water resources by integrating rivers, drains, ponds, lakes, reservoirs, and aquifers into a unified water resource system?
- Is 24x7 water supply boon or bane for water resource management?
- How are cities increasing water revenues and reducing water losses?
- Does laying dual pipeline strategy with different water quality and water uses help or hinder efficient water resource management?
- How are cities leading on the preparation of their urban river management plans?
- Despite numerous occurrences, are cities ready for flood or drought related natural disasters?

D1: Nashik

THE TEAM FOR PRESENTATION FROM NASHIK:

Sandeep Nalavade [Additional Municipal Commissioner]
SM Chavhanke [Superintending Engineer]
Prakash Thavil [Chief Executive Officer]
Harshad Wagh [Deputy General Manager (EWS)]
Harshad Dhande [Project Director]

Highlighted the Water Management Plan for the city of Nashik which is located about 180 km northeast of Mumbai. With a population of 2.1 million, Nashik is the sixth most populous city in Maharashtra. The Godavari river flows through Nashik and is a major component of the socio-cultural-religious aspects of the city. Nashik is known as Maharashtra's "Spiritual Capital" due to the presence of many pilgrimage destinations. With the establishment of many vineyards and wineries in Nashik, it is also known as the winery capital of India.

Large-scale industrialization and the presence of agro-based industries have transformed Nashik from a traditional pilgrimage destination to a modern, vibrant city. The growth has been accompanied

by increased demand for water and water management challenges.

Nashik Municipal Smart City Development Corporation Limited was formed in August 2016 and envisions 52 projects at a total estimated cost of approximately Rs. 2,195 Crores. "Green Goda Project" is a major component of the ambitious area-based development (ABD) for improving the Godavari River and developing the riverfront and adjacent areas in central Nashik. It consists of cleaning the Godavari River by dredging and de-silting the riverbed, installation of pneumatically controlled mechanical gates to reduce flood levels and beautification of the riverfront to create an attractive and active public space. The plan envisions a 24x7 water supply, upgrade of wastewater and stormwater collection network. The 598-acre ABD has 20,415 households with a current population of 91,867. Drinking water supply is 160 lpcd and non-revenue water (NRW) is 43.5%. Minimum water bill for a 15 mm diameter residential connection is Rs. 675/month. Water tax target for 2019-2020 is Rs. 65 Crores, and Rs. 29.22 Crores have been collected to date. For almost 2 lakh citywide

connections for water, the total arrears are almost Rs. 66 Crores. Three raw water pumping stations have a capacity of 612 MLD and 7 water treatment plants can treat 611.5 MLD. Total length of water pipeline is 2,256 km.

The following interventions have been identified for a sustainable water supply scheme:

- Use of best practice in management of water supply system
- Creating climate resilience infrastructure
- Replacement of entire water supply pipeline for reduction of NRW
- Support in increasing the collection of revenue system
- Human resource development – Capacity building and training
- Converting intermittent to 24x7 water supply system for Nashik city

The following initiatives have been taken to improve the water supply sustainability:

- Drives for revenue recovery (Both Commercial and Residential)
- Nearly 2,900 connections severed for non-payment of bills (From March 2019)
- SMS notification for bills proposed in future
- Wide publicity through IEC measures proposed for awareness of public to pay water tax
- Raising public awareness about the following expectations from citizens:
 - Timely payment of the water tax arrears and current bills
 - Recycled/reuse of water in accordance with sustainable practices
 - Promote and adopt rainwater harvesting practices

LARGE-SCALE
industrialization and the presence of agro-based industries
have transformed Nashik from a traditional pilgrimage
destination to a modern, vibrant city



**Presentations and Discussions:
Presentations on Global Best Practices
and Experiences (Nashik)**

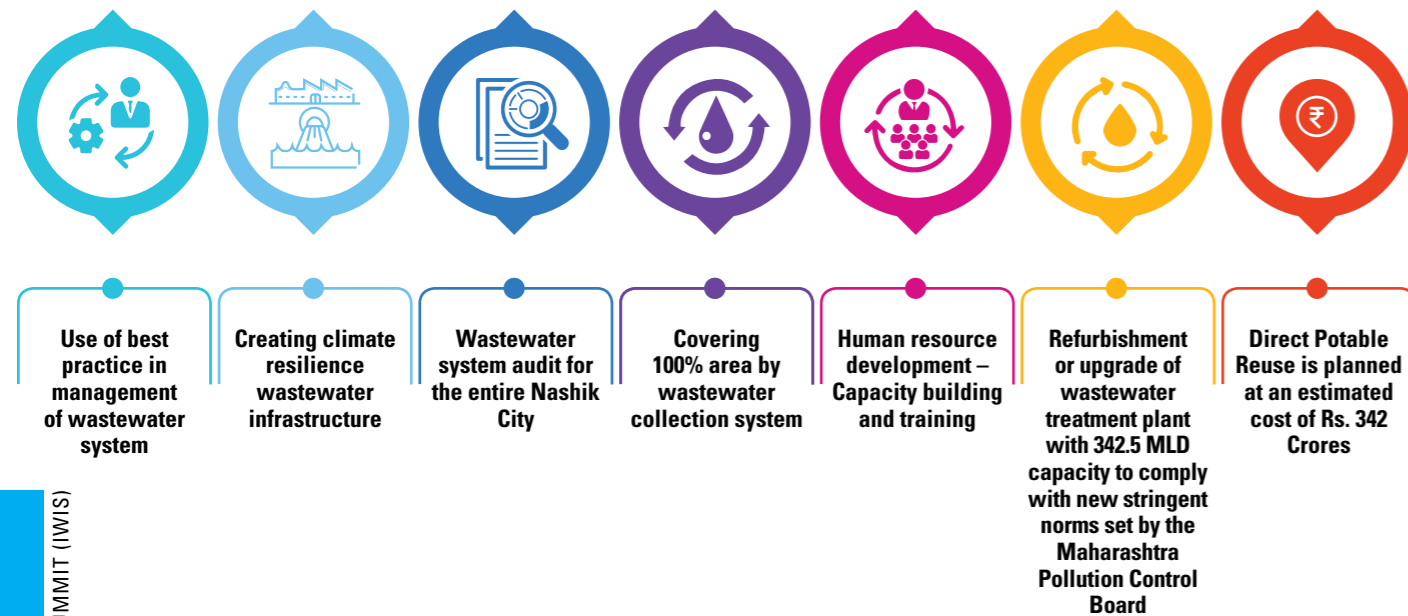
Wastewater generated in Nashik is about 290 MLD with installed wastewater collection system capacity of 360 MLD. Approximately 85% of the service area is covered by the wastewater collection system with a total length of 1,619 km. An additional 210 km of collection system is expected to be completed in two years. The municipal wastewater treatment plant receives about 270-280 MLD of wastewater.

Until recently there was no stormwater management system in Nashik. However, approximately 358 km of stormwater

collection system was installed between 2009 and 2013 to handle the stormwater in Nashik. Diameter of the stormwater collection system ranges from 300 mm to 1800 mm. Catch pits and other related works are in progress. Total cost of the storm water project is estimated to be Rs. 340 Crores.

With the completion of the Smart City Project, Nashik expects to reduce its NRW and move towards an equitable 24x7 water supply, among many other improvements.

The following interventions have been identified for a sustainable wastewater management:



DISCUSSION

Conversion from intermittent water supply to 24x7 supply is an ambitious goal but must be started in a small area first and expanded slowly for the entire city. Must use low price (at or below cost) for the lowest tier user as recommended by HUDCO to be affordable for basic water use by common public. As the usage goes into higher tier, the price should increase in a steep rate such that higher users of water pay much higher price than the production cost to subsidize the basic users. Non-revenue water due to leakage is 50-60% which is too high and must be lowered to enable 24x7 supply. 24x7 water supply benefits and the resulting reliability and trust must be weighed against the extra water loss while answering this question. We must confront the moral and ethical dilemmas of most of the decision makers, who have had all the benefits of a private 24x7 water supply, indoor plumbing, and flush toilets for generations. How can those decision makers look in the eyes of millions of people who have struggled hard to almost achieve their dream of running water, only to be told that they can't have it because it's no longer sustainable? Considering resiliency plan to deal with extreme weather events like floods and droughts.

WASTEWATER
generated in Nashik is about 290 MLD with installed wastewater collection system capacity of 360 MLD. Approximately 85% of the service area is covered by the wastewater collection system with a total length of 1,619 km



BADKHAL LAKE WATER

Level started decreasing in 2000 due to quarrying and mining activities in the vicinity and by 2005 it was completely dry leading to adverse ecological effects and loss of employment for those associated with recreational activities on the lake front

D2: Faridabad

THE TEAM FOR PRESENTATION FROM FARIDABAD:

Monika Gupta [Addl. CEO]
Suneet Gupta [Team Leader, PMC]
Mayor Kumar [Water Expert, PMC]

Focused on Badkhal Lake rejuvenation, one of the major components of the Faridabad Smart City programme. Faridabad is a satellite city located southeast of Delhi and has an area of about 208 sq. km. With a population of 14.04 lakhs, it is the largest city in Haryana. Badkhal Lake, on the west side of Faridabad, was formed in 1960 after the construction of a dam joining two hills near Badkhal village and Aankhir village and was a source of freshwater for nearby communities and farms.

Badkhal Lake water level started decreasing in 2000 due to quarrying and mining activities in the vicinity and by 2005 it was completely dry leading to adverse ecological effects and loss of employment for those associated with recreational activities on the lake front.

Several proposals were considered for reviving the lake and the selected option was for filling the lake with treated effluent from a new wastewater treatment plant. Further, it was decided to re-develop the lake front for recreational and tourism activities. All these improvements would be carried out under the Smart City plan which decided to focus on area-based development (ABD)

of 1,267 acre that includes Badkhal Lake. Population of the ABD is around 37,000.

The goals of the Badkhal Lake rejuvenation project are:

- Restoration of disturbed ecology
- Environment and ecosystem improvement
- Reuse of wastewater
- Groundwater recharge
- Ecotourism development
- Revenue generation

Volume of water required to fill Badkhal Lake up to a level of 215 m and a surface area of 440,000 sq m is 987 MLD. A 10 MLD wastewater treatment plant would generate approximately 9.5 MLD treated effluent. With an estimated loss of 2.28 MLD to evaporation and seepage, 7.22 MLD would be available to fill the lake. At that rate, it would take about 140 days to fill the lake to the desired level.

After consideration of different treatment alternatives and using a technology assessment tool from a consortium of seven IITs, sequential batch reactor technology was chosen as the most appropriate for the site.

The proposed effluent quality is shown below:

- pH: 6.0 – 9.0 standard units
- BOD₅ ≤ 10 mg/l
- Turbidity ≤ 2 NTU
- Cl₂ residual ≥ 1 mg/l
- No detectable Fecal coliforms

IIT Roorkee evaluated the geotechnical features of the lake and recommended the following:

- Removal of lakebed vegetation
- Rolling lakebed with heavy rollers
- Bentonite treatment to seal the lakebed for reducing seepage from the lake

Total cost of the Badkhal Lake improvements is estimated to be around Rs. 73.5 Crores.



Presentations on Global Best Practices and Experiences (Faridabad)



DISCUSSION

The proposed secondary treatment may not be adequate for maintaining a good lake. Nitrogen and phosphorus in the treated effluent will lead to algae growth. Nutrient removal is necessary to avoid eutrophication. Nitrogen removal is needed to avoid contaminating groundwater with nitrates. There was no original plan for nutrient removal. The project team learnt about high phosphorus levels in Faridabad wastewater after the tender for the work was already floated. To reduce phosphorus levels in Badkhal Lake, diversion of industrial wastewater with high phosphorus concentration to another treatment plant is being considered. Also, considering nutrient removal treatment at the plant that will provide treated effluent for the lake. Lining the lake bottom with bentonite to reduce water percolation. Some water percolation has been planned to recharge the local aquifer. However, widespread pumping has lowered the aquifer level so much that little bit of percolation from Badkhal Lake will have virtually no effect on the water



table. Groundwater recharge with stormwater during heavy rains and floods is a possibility but has not been planned. Lack of planning for restoring, maintaining, and protecting aquatic life in Badkhal Lake. Provisions must be made for fountains or other methods to provide adequate dissolved oxygen for aquatic life.



BADKHAL LAKE
rejuvenation, one of the major components of the
Faridabad Smart City programme

D3: Indore

THE TEAM FOR PRESENTATION FROM INDORE:

Ritesh Rangari [Consultant, Indore Municipal Corporation]
Sandeep Soni [CEO, Indore Smart City Development Limited]
Saurabh Maheshwari [Assistant Engineer, Indore Smart City Development Limited]
Devish Kothari [Assistant Engineer, Indore Smart City Development Limited]
Harshit Tiwari [Assistant Engineer, Indore Smart City Development Limited]

Highlighted the plan for water management by Indore Smart City and Indore Municipal Corporation. With an area of 276 sq. km. and a 2019 population of 28.6 lakhs, Indore is the largest city in the state of Madhya Pradesh. For three consecutive years, Indore has been ranked as the cleanest city in India. Indore has two rivers (the Kanh and the Saraswati) and six major nallahs. Among the city's major waterbodies are 24 ponds, 360 wells and 25 *baolis*. Indore has

two drinking water treatment plants with a combined treatment capacity of 540 MLD, and three wastewater treatment plants with a combined treatment capacity of 335 MLD.

The entire water ecosystem in and around Indore has been affected by:

- Pollution and waste outfalls into rivers and nallahs
- Contamination of groundwater
- Encroachment and unmanaged habitation
- Silt deposition and narrowing of the river and nallah channels resulting in frequent flooding
- Groundwater depletion

The following strategies were adopted to improve the Indore water ecosystem:

- Divert sewer outfalls from rivers and nallahs by constructing interceptors
- Discharge treated effluent from decentralized wastewater treatment plants to rivers, thereby connecting the city to the rivers

- Rehabilitation of 11 existing stop dams
- Clear encroachments, clean and dredge rivers
- Riverfront development including restoration of cultural heritage
- Plant trees and plants along the riverbanks
- Adopt best solid waste management practices and public awareness campaign against dumping refuse, debris, and demolished material into and along the rivers

Indore Smart City Project has proposed a 10 MLD decentralized plant and the AMRUT (Atal Mission for Rejuvenation and Urban Transformation) project has proposed five additional decentralized plants totaling 67 MLD capacity that will generate a total of 77 MLD treated effluent to make the two rivers in Indore flow year around. Eleven check dams have already been repaired or proposed to be repaired. Under the Smart City initiative 3.9 km of riverfront development has been planned for the area-based development (ABD). The plan is to scale up the riverfront development to 15 km (Pan City). Resettlement of more than 1,350 slum-dwelling families has

improved their living conditions. Average of 30 m river widening has resulted in no flood in the last two years. Approximately 40 MLD of untreated wastewater was diverted to treatment plants resulting in improved water quality and reduction in pollution and foul odour. A total of 22 ponds, 218 wells and 25 *baolis* in Indore were rejuvenated. These and associated improvements have provided the citizens the opportunities to appreciate local art, music and culture, and improved the real estate prices in the heart of the city.

DISCUSSION

Drinking water source is the Narmada River which is 72 km away. Indore Smart City includes the oldest part of Indore. Groundwater level in the area has risen and the Kanh and the Saraswati rivers are alive and flowing throughout the year in and around the city. There are also plans for a network of reuse water. Most of the stormwater management plans are piecemeal, there should be integrated planning to optimize the overall cost so as to minimize the cost to the public.



INDORE SMART CITY
Project has proposed a 10 MLD decentralized plant and the AMRUT (Atal Mission for Rejuvenation and Urban Transformation) project has proposed five additional decentralized plants totaling 67 MLD capacity that will generate a grand total of 77 MLD treated effluent to make the two rivers in Indore flow year around

D4: Singapore

THE TEAM FOR PRESENTATION FROM SINGAPORE:

Moh Tiing Liang [Deputy Director, PUB, Singapore's National Water Agency]

Focused on how the small island city-state in Southeast Asia achieves water sustainability, where access to water is universal, affordable, efficient and of high quality. It has an area of 716 sq. km and a population of 5.7 million. Average annual rainfall is 2400 mm. Singapore has one of the world's best managed water systems. It has clean waterways and reservoirs, 100% potable water supply at tap and 100% of the population served by modern sanitation. However, just 60 years ago Singapore was a developing country

where the absence of proper wastewater facilities and discharge turned rivers into open sewers, where seasonal floods were a common occurrence in low lying areas, especially when heavy rainfall coincided with high tides, and where only 50% of the population was served by the sewerage network, while the other 50% depended on night-soil collection.

How did Singapore transform its water system in less than 60 years from one of the worst in the world to one of the best? The presentation highlighted the following six strategies for Singapore's spectacular success with water sustainability and resiliency:

- **Get the governance right** – In Singapore, a single agency in one Ministry manages the



- **Capture every drop of rain** – Start with urban planning and tackle pollution
- **Collect every drop of wastewater**
- **Diversify water sources** – Develop more than one supply source to increase water supply resiliency (Singapore uses desalinated water, recycled water, imported water from Malaysia and water from local catchment); close the water loop - recycle water

- **No free (or even subsidized) water** – rain is free, but water and wastewater treatment are not; water tariff must reflect scarcity value of water; investment is required to build water treatment plants and to lay the water distribution pipes
- **Conserve water** – everyone plays a part; Singapore has lowered its per capita use from 165 LPCD in 2003 to 143 LPCD in 2017, 141 LPCD in 2018 and expects to lower it to 130 LPCD by 2030.

Presentations on Global Best Practices and Experiences (Indore and Singapore)

Innovative integrated water management approaches such as the reuse of reclaimed water, the establishment of protected areas in urban rainwater catchments and the use of estuaries as freshwater reservoirs have been introduced along with seawater desalination in order to reduce the country's dependence on water imported from its neighbouring country, Malaysia. The contract to import water from Malaysia expires in 2061 and Singapore is striving to achieve water independence by 2060 so that it may function without any water stress in case the water import contract with Malaysia isn't renewed.

DISCUSSION

Singaporeans must deal with water in an innovative and sustainable way because water is an existential issue for them. If

Singapore doesn't manage all its water properly, it can't exist, grow and prosper. The city/state has small land area and dense population, so it is not feasible to have decentralized treatment plants – only centralized treatment is possible. Singapore doesn't have a large upstream watershed to collect rainwater. The city/island area is the only watershed available. Fortunately, Singapore is one of the cleanest places on earth and collects all the rainwater which is part of its one water sustainability strategy. Singapore emphasizes and educates the public about the value of water as well as the true cost of water. Water conservation is emphasized at every step of the way. Water management is a never-ending continuous process and as water professionals, we must strive to find ways to conserve and improve water treatment, delivery and management.

THE REUSE OF
reclaimed water, the establishment of protected areas in urban rainwater catchments and the use of estuaries as freshwater reservoirs have been introduced along with seawater desalination in order to reduce the country's dependence on water imported from its neighbouring country, Malaysia



D5: Varanasi

THE TEAM FOR PRESENTATION FROM THE CITY OF VARANASI:

Vikramaditya Singh Malik [Chief Operating Officer, Varanasi Smart City Limited]

Focused on water and river conservation interventions in the city, and emphasized CRTM, which stands for Conservation, Recharge, Treatment and Management. Early maps of Varanasi show numerous ponds, *pokhras*, *kunds* and other large and small waterbodies were components of the city's water system for which the Ganga River was the feeder. As Varanasi grew, these waterbodies were either converted into open spaces or were filled in for urban expansion of the city. The current

initiatives aim to rejuvenate and preserve the remaining waterbodies of the city which are not only ecological assets but also the cultural assets of Varanasi.

Several *kunds* in the old city have been rejuvenated and revitalized as part of different schemes. In rural areas, 298 ponds, 13 check dams and 1,238 rooftop rainwater harvesting systems were built and 253 traditional waterbodies/tanks were renovated. In addition, 3,233 soak pits, 67 stabilization ponds and 144 bore well recharge structures were built. A gully plug and 32 percolation tanks were constructed, and more than 9.11 lakh saplings were planted.

In urban areas, a pond was constructed and 90 rooftop rainwater harvesting units were installed. Additionally, 93 soak pits were constructed, and more than 1.887 lakh saplings were planted. Rainwater harvesting structures were installed at 130 government buildings in the city, and a total of 1,409 government buildings (including primary schools, block development offices, *tehsil* offices and police stations) in the district.

To help improve groundwater levels, soak pits were constructed near all hand pumps in the Varanasi District. In addition, a total of 800 individual beneficiary

ponds have been proposed in all blocks of the district under "Mission-800" which is expected to generate more self-employment opportunities through increase in income of farmers.

Also in the Varanasi District, river restoration is being carried out through improvements of the Varuna River and the Nad River embankments. A total of 31 km of embankment improvements are ongoing in 30 *Gram Panchayats*. Public education and awareness campaign have been organized about water conservation and plantation activities.



Presentations on Global Best Practices and Experiences (Varanasi)



Under the Smart City Mission, an area-based development (ABD) area has been delineated. Some of the important features of the smart city initiatives are:

- Rainwater harvesting, wastewater recycling and stormwater reuse
 - Improved sanitation facilities and effective management of wastewater
 - Promotion of smart multi-functional poles and energy efficient solutions
 - Rejuvenation of sacred waterbodies
- Redevelopment and beautifications of several ponds/*kunds* have been completed and several more are being planned. Using water SCADA

and information technology, Varanasi Smart City is planning to implement complete water management system across the city to cover the following:

- Water Quality Management
- Water Leakage Management
- Water Supply Management
- Water Infrastructure Asset Management
- Reporting and Analytics

The city currently generates 300 MLD wastewater, but the 2016 treatment capacity was only 190 MLD. Currently three wastewater treatment plants provide a treatment capacity of 380 MLD, to be increased to 430 MLD by March 2020.

DISCUSSION

Rainwater harvesting is an excellent idea, but provisions must be made for the infrastructure to be maintained and made sustainable. Mechanism for funding operation and maintenance must be provided. Groundwater recharge must be done carefully. Surface water will recover from pollution much faster than groundwater can – therefore, great caution must be exercised to prevent contamination of aquifers. Public education is extremely important whether it is for conservation, rainwater harvesting or aquifer recharge. Restoring of old *kunds* to attract visitors and create public spaces around them will bring the public closer to water.





HIGHLIGHTS

There were presentations from four Indian smart cities (Nashik, Faridabad, Indore, and Varanasi). Also, there was a presentation from one international smart city, Singapore. Presentation from each city was followed by a moderated discussion between the lead discussants and the audience. Since smart cities are relatively recent in India, most of the results from the domestic cities were more aspirational than what has been already achieved. Even what has been achieved is more about the number of projects completed, the miles of pipes installed or the number of plants built, rather than the resulting improvements in the level of service or about improved water quality and quantity.

There was consensus among the lead discussants, audience members, and moderators about the following general comments during the discussion:

- Answers to questions should be based on quantifiable studies instead of personal opinions
- Trust and reliability of the water system are critical
- Cost of unreliable water services on the customer must be considered
- Water issues are local – local control, management and governance are crucial
- Concept of micro-water equilibrium
- Water pricing is critically important for sustainability
- Water-equity must be considered for smart water planning – water supply for slums
- Little or no room for innovation in CPHEEO manual
- Need to make the manual more flexible for smart cities to promote innovation

- Easier to work with green field development, but more challenging with brown field development
- Need guidelines for brown field development

The consensus developed during the discussions regarding the answers to the salient questions are summarized below:

How are cities creating new water resources by integrating rivers, drains, ponds, lakes, reservoirs, and aquifers into a unified water resource system?

- Not much integration seen in Indian cities, mostly piecemeal work at present
- Need to connect the dots
- Need for integrated water resources planning
- Sustainability of water resources is critical
- Proper land use planning requires dedicating a certain % of area for water bodies

Is 24x7 water supply boon or bane for water resource management?

- This topic brought out the most passionate and extensive discussion from the audience.
- 24x7 water supply is a worthy goal but should be implemented only after water leaks have been reduced to an acceptable low level and proper water tariffs have been implemented to encourage conservation.
- Reliable water supply and water quality improvement versus certain acceptable level of water loss must be weighed carefully.
- With 24x7 water supply, usage will go up and there will be proportionate increase in the volume of wastewater which has to be treated and managed. Wastewater treatment is significantly costlier than water treatment. The increased cost of wastewater treatment must be

Water Impact in Smart Cities as Integral Part of River Restoration and Conservation Strategy

considered when we talk about 24x7 water supply.

- Even with the current level of significant leakage and high volume of non-revenue water, customers are making their own “24x7 supply” at great cost and inconvenience – whether it is an expensive, sophisticated system with underground concrete tanks, pumps, overhead tanks, and internal plumbing, or with water of questionable quality from tanker trucks, or simply with buckets and mugs. Each option is costly to the respective customers and fraught with potential for water contamination resulting in poor water quality and decline in public health.
- Because of the unreliable nature of current water supply, most customers are drawing all the water they need for 24 hours in the short time (say 2-hours) that the water is running and hoard at least 2-3 days of water at their homes at great cost and inconvenience every time the water is available. If there is a reliable supply of water 24x7 water all those extra costs and inconvenience will go away. Water use will not increase that much and could be easily handled by reduction in water loss due to leakage.
- Customers are incurring extra costs due to the use of point of use devices such as filters followed by UV disinfection, or filters followed by boiling. Each option requires considerable capital and operation and maintenance costs.
- There is demand for reliable, high quality, 24x7 water supply and most customers are willing to pay for it because they are doing so indirectly with their cumbersome home treatment systems.
- It would be more economical to provide

a reliable public water supply than creating mini 24x7 supplies at individual residential units.

- Water leaks and water loss must be reduced to acceptable low levels.
- 24x7 water supply benefits and the resulting reliability and trust must be weighed against the extra water loss while answering this question.
- We must confront the moral and ethical dilemmas of most of the decision makers, who have had all the benefits of a private 24x7 water supply, indoor plumbing, and flush toilets for generations. How can those decision makers look in the eyes of millions of people who have struggled hard to almost achieve their dream of running water, only to be told that they can't have it because it's no longer sustainable?

How are cities increasing water revenues and reducing water losses?

- Leak detection sensors
- Remote sensing
- Two-stage metering provides a better picture of water loss
- Community-level metering
- Individual residential unit metering in multi-residential housing complexes

Does laying dual pipeline strategy with different water quality and water uses help or hinder efficient water resource management?

- Dual pipelines for new construction only or are we talking about retrofitting older areas too?
- There is no market for recycled water because water is free. When you give water for free, people will not accept recycled water as a resource.



Water Impact in Smart Cities as Integral Part of River Restoration and Conservation Strategy



RELIABLE WATER

supply and water quality improvement vs. certain acceptable level of water loss must be weighed carefully

- Need more data about dual pipeline systems – What quality and treatment levels should be required? What quality of recycled water is acceptable to the public for aesthetic and health reasons, treatment costs (Capex and Opex)?
- Practical limit on how many times the water can be recycled due to the increase in total dissolved solids (TDS) during every cycle of use.
- Data on potential for cross-connection between dual systems and its public health implications.
- Need flow augmentation to maintain reuse water TDS at acceptable levels.
- Pros and cons of centralized versus decentralized systems.
- Cost of land in urban areas is high making decentralized system too expensive. We have to use centralized and regional systems in urban areas. When we don't have space to lay down pipes, how can we find the space to build a treatment plant?
- Decentralized preferred but should not be dogmatic. Decision should be made on a case-by-case basis depending on site-specific conditions.
- Instead of a completely closed-loop reuse system using dual pipeline, there should be discharge of some treated wastewater into natural or artificial water bodies (streams, wetlands) for integration with recycling systems as well as to maintain required environmental flows in streams for ecological reasons.
- Lack of qualified operators for numerous decentralized systems. Currently there is a lack of qualified operators for a few centralized systems. The operator shortage will be more acute as numerous decentralized systems are brought into operation.

How are cities leading on the preparation of their urban river management plans?

- Piecemeal and fragmentary work so far. Need a more cohesive approach.
- Need for integrated water resources planning.
- Sustainability of water resources is critical.
- Limited groundwater recharge projects are no match for the massive withdrawal of ground water.
- Severe and widespread lowering of groundwater table has drastically reduced the number of springs, dried up old wells and ponds, and acutely lowered surface water flows in rivers and streams.

Despite numerous occurrences, are cities ready for flood or drought related natural disasters?

- Unfortunately, for most cities, not yet.
- Significant work is needed to create resilient systems to handle natural disasters and extreme events, such as flood and drought.
- Need more cohesive and integrated approach to deal with floods and droughts.
- If we have more local water storage (surface water storage or groundwater recharge or aquifer storage and recovery), we can deal with floods as well as well as droughts.
- Cost of land in urban areas is high, so decentralized system will be expensive. We must use regional system.
- When we don't have space to lay down pipes, how can we afford to build a storage for flood control in urban areas?
- Build underground storage capacity where land is not available or too expensive above ground.

TRACK

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DELIVERING JAL JEEVAN MISSION IN SYNERGY WITH RIVER RESTORING AND CONSERVATION ACTIVITIES IN RURAL INDIA - BEYOND GANGA REJUVENATION

THEMES

- Presentations from States of Bihar and Odisha

DAY 2:

Friday, December 6, 2019
14:00 – 15:30 h, 16:00 – 17:30 h

DAY 3:

Saturday, December 7, 2019
10:00 – 11:30 h, 12:00 – 13:30 h

VENUE:

Hall 6, Vigyan Bhawan,
New Delhi

CHAIR:

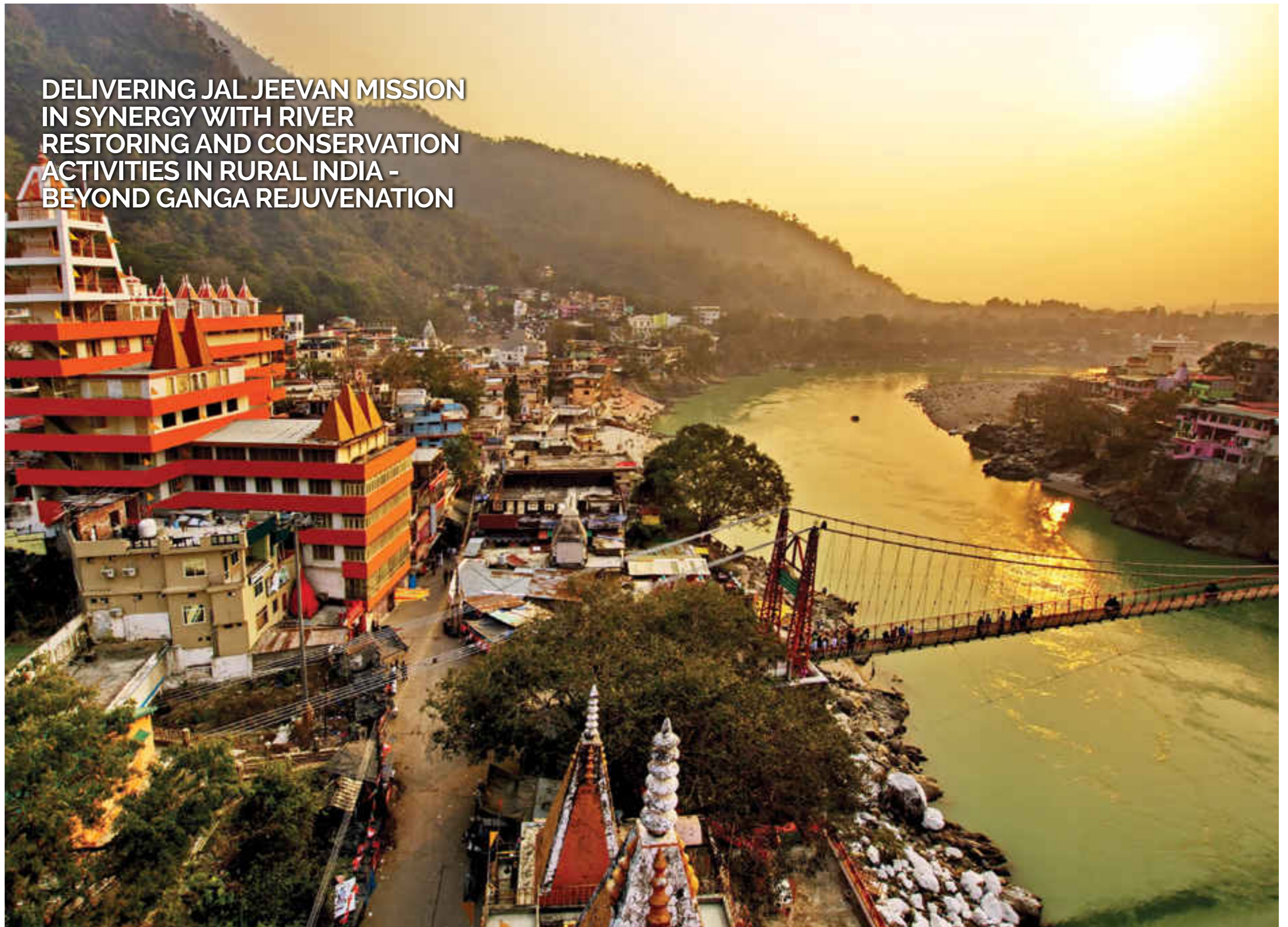
Arun Baroka [Additional Secretary,
SBM & CVO, Department of Drinking Water
and Sanitation, Ministry of Jal Shakti, GoI]

MODERATORS:

Ajay Shanker Singh [Chief Controller
Accounts]
Brajesh Kumar Dubey [cGanga, IIT KGP]
Indumathi M Nambi [cGanga, IIT M]

LEAD DISCUSSANTS:

Anshuman [TERI]
BS Murty [IIT M]
Ligy Phillip [IIT M]
Shyam Prasad [Director, Clear Water
Dynamics, Bangalore]
Somnath Ghosal [IIT KGP]
Suresh Kumar Rohilla [Senior Director, Centre for
Science and Environment, New Delhi]



Delivering Jal Jeevan Mission in Synergy with river Restoring and Conservation Activities in Rural India - Beyond Ganga Rejuvenation

PROBING THOUGHTS

RURAL settlements in India, sparsely populated as compared to urban areas, were traditionally engaged in agriculture, livestock management, and small-scale trade and crafts that did not burden the rural environment. Traditional water management in rural India was also largely sustainable and balanced local water needs and health concerns with environmental needs through diverse, innovative and locally-suited adaptations devised by the communities themselves. This approach changed in modern India with increasingly centralized water resources schemes which were not always the best suited for local conditions and needs. Besides, many changes have occurred in present times with regard to trade, industry, agriculture, lifestyle, healthcare, housing, transport and other aspects of rural life. Therefore, in the context of the changing rural environment in India and the new rural water supply programme of the Government of India's Jal Jeevan Mission (JJM), new considerations are needed in rural water management. It is imperative now to synergise modern scientific knowledge (of academic

and research experts), technical expertise (of government agencies) and traditional and grassroots knowledge of local communities to fully meet the developmental needs.

The sessions of this Track were designed to review the experiences of government agencies of different States of India in rural water and wastewater management and the views of experts on synergising the Jal Jeevan Mission with River Restoration & Conservation. A systematic and practical understanding of the scientific, technological and governance principles that may produce lasting success for rural water management was aimed for. The key issues that underlie this objective were highlighted as:

a) How can rural economies develop by integrating rivers, drains, ponds, lakes, reservoirs and aquifers into a unified water resource system?

There are often multiple sources of freshwater in and around villages – rivers, natural drains, ponds, lakes, reservoirs and aquifers – to tap water from. Selective use of specific sources

often over-exploits the source while other water sources decay due to neglect. Hence, it is advantageous to develop and maintain interconnections between the different types of water resources, i.e. surface water bodies and aquifers so that surplus water is readily transferred from one water body to another that is deficient in water. Hence, how can sustainable integration of local and regional water resources be achieved through the combined efforts of planners, executors and local communities?

b) What are the challenges in managing black and grey water in rural settings and how are these challenges being met?

Though rural India has developed considerably with the advent of modern agriculture, road networks, rural electrification, industrial expansion, etc., the supporting amenities of water and wastewater management have not developed commensurately, leading to health and developmental constraints. Wastewater management in rural settings, in particular, is seldom addressed. With rural water supply through the Jal Jeevan Mission and the consequent increased wastewater generation, there is an obvious need to mitigate the adverse impacts of enhanced rural wastewater generation. Can polluted black water be separated from grey water and subjected to rigorous treatment, while the



Delivering Jal Jeevan Mission in Synergy with river Restoring and Conservation Activities in Rural India - Beyond Ganga Rejuvenation



grey water component is more easily treated and reused in some circumstances?

c) What are the main lessons learnt from the experiences of rural water and sanitation managers on the implementation of universal toilets for the "open defecation free" initiative?

With coverage of household sanitation facilities in rural India under the Swachh Bharat programme, India has been declared as "open defecation free". The rapid transition from the pervasive practice of open defecation in much of rural India to indoor defecation is impressive,

but it is important to understand its successes and drawbacks for sustainability and improvements where needed. Hence: (i) What are the key factors behind the success of the Swachh Bharat programme? (ii) What are the types of toilets adopted under the given scheme, and what are their relative advantages and disadvantages? (iii) What is the impact of the change on human hygiene and the environment? (iv) Are improvements needed in the toilet facilities installed on account of any unsatisfactory performance, user dissatisfaction and/or environmental impacts?

d) How are animal wastes and human consumption wastes (such as food and plastics) being managed in the context of water resources?

The rural environment has changed rapidly over the past decades with significant changes in Land Use/Land Cover and consumption patterns. These changes have occurred due to newer technologies, goods and services being widely available in rural India in tandem with decrease in rural poverty. Thus, newer and higher quantities of anthropogenic wastes are being discharged into the rural environment including emerging pollutants such as plastics and pharmaceuticals. While the full impact of such pollutants on the environment may not be known yet, it is certain that the adverse impacts of human food wastes and animal wastes (excreta) on ecology, hygiene and water bodies need redressal. What comprehensive set of technologically sound community-based measures

need to be adopted to redress the problem of animal wastes and human food wastes?

e) What community engagement models for rural water management have been successful and how?

The Swachh Bharat programme resulted in rapid transition from open defecation to indoor toilet use in much of rural India in recent years, which was possible only by actively involving rural communities in changing their attitudes and practices that had held sway for millennia. Understanding how community involvement helped in achieving this task is important to consolidate the change. Thus, (i) What were the role and involvement of rural communities and local governance bodies with regard to achieving the ODF change in rural sanitation? (ii) What are the unaddressed concerns of rural communities with regard to the Swachh Bharat programme, and what means are being adopted to allay these concerns for irreversible success to be achieved?

THE SYNERGY OF
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and grassroots knowledge of local communities is essential
to fully meet the developmental needs

E1: Bihar

BIHAR state's presentation highlighted the launch of the state's 'Jal Jeevan Hariyali Abhiyan' to maintain environmental and ecological balance by reviving more than 1 lakhs ponds (and Ahar-Pynes) and 3 lakh wells in different districts of Bihar. It also highlighted the problems of (i) increasing floods with higher HFLs in many rivers, surmised to be due to erratic monsoons and rise in riverbed levels by siltation, and (ii) the difficulty in ensuring minimum flow in River Ganga at the downstream end of the state (due to the flow requirement at Farakka barrage) while receiving low flows at the upstream end of the state in the lean season. The following measures were recommended for the rejuvenation and sustainable use of the rural water resources:

- Sustainability of the rejuvenated ponds and wells will depend not only on water storages but also on solid waste management i.e. by preventing
- harmful solid wastes from entering the water bodies.
- The multi-departmental integrated approach with the Rural Development Department as the nodal department, as adopted by the state, is laudable since it brings together the concerned government departments, but their respective domain knowledge and expertise must be synergistically combined.
- Other stakeholders – common people and local communities – must also share in the decision making and management of water-wastewater infrastructure.
- Local communities should not only be made aware of the issues, but also trained to maintain the local water and wastewater management systems.
- Traditional knowledge, beliefs and practices must be combined with modern scientific knowledge to ensure sustainability of water and



'JAL JEEVAN HARIYALI Abhiyan' in the state of Bihar reviving more than 1 lakhs ponds (and Ahar-Pynes) and 3 lakh wells in different districts

- other natural resources as shown by the successful experiences of West Europe and North America.
- For handling black water and grey water from household level onwards, the details of sewerage connections and sewage collection system, and the type, distribution and locations of STPs and WTPs must be well planned and evaluated from time to time.

- Local water quality monitoring is a must, and a comprehensive water quality monitoring plan and infrastructure must be established.
- Relevant details of the work being carried out should be documented with focus on the specific new ideas and lessons learnt, the mistakes made, and how they were rectified.

E2: Odisha

Odisha state's presentation highlighted several problems and the means adopted to overcome them, viz.:

- (i) Water policy is very ad hoc and a relook at the policy framework is needed. By 2024 every Indian household is scheduled to have access to piped water supply but it does not mean universal access to safe drinking water. However, we look at Jal Jeevan Mission (JJM) as not just a drinking water supply program but as water security.
- (ii) Water supply is being considered in Odisha in an integrated manner as a subject or service in a geographical area, not in terms of individual projects. Hence, the RWSS was shifted from the Rural Development Department and brought under the ambit of the Panchayati Raj Department to connect to people and to work in a holistic manner.
- (iii) In Odisha, only a few districts and blocks had all the water supply assets, and even within districts, blocks and *panchayats* there were differences. There were wide geographical disparities and various other criteria for disparities: far off villages did not have access, and scheduled caste & schedule tribe hamlets had no access to water at all.
- (iv) One doesn't get to know on a real time basis where a tube well is dysfunctional or where a piped water supply is dysfunctional. Maintenance and grievance redressal are now in proactive mode, and are hence a priority.
- (v) We are a disaster-pronestate and have an acclaimed disaster response mechanism. To build disaster-resilient water supply infrastructure, we have the most renewable energy dual solar pump installations, but they too need protection from disasters.
- (vi) Odisha introduced technology through the involvement of technical institutes like ISRO and ORSAC so that an infrastructure developed

now does not go dry after 10 years. The back end work of seeing that the water reserve stays well is the work of water resources.

- (vii) Odisha does not have any structured policy to handle grey water as in the BASUDHA policy earlier. Grey water management will need to be tuned into the policy.
- (viii) Some other problems faced by the state include (a) groundwater salinity influx in coastal areas, (b) presence of iron and spreading of fluoride in GW, (c) lack of credibility of rural water & sanitation programme due to adopting a purely

engineering approach, and (d) disconnect with people and people's representatives.

Some additional measures were recommended for the rejuvenation and sustainable use of rural water resources:

- Black water, grey water and solid waste management are essential to be built into the rural water supply and management scheme.
- Relevant details of the work being carried out should be documented with focus on new ideas, the lessons learnt, and the mistakes made and how they were rectified.

GREY WATER
management will need to be tuned into the policy, as the state does not have any structured policy to handle grey water as in the BASUDHA policy earlier



Delivering Jal Jeevan Mission in Synergy with River Restoring and Conservation Activities in Rural India- Beyond Ganga Rejuvenation

TRACK E also included several presentations of case studies and threw up a wide variety of vexatious issues focussed on synergising on the Jal Jeevan Mission with River Conservation and Holistic Water Resource Management in the rural context. The important issues are summarized as follows:

Ligy Philip, IIT Madras

We developed a sustainable water management program in some rural areas of the state. Our principle was that each and every village has to be viewed independently and the resources available there must be identified. Now, for rural populations if you have natural streams, ponds and other water sources nearby then you don't need to supply 70 lpcd of water, they need only good

quality water for drinking and cooking purpose. But wherever water is not there you have to give more quantity. Hence:

- Right from day one, when we entered any village we took the stakeholders into confidence, doing a socio-economic survey, talking to the people, taking village leaders into confidence, and then keeping communication



EACH AND EVERY
village has to be viewed independently and the resources available there must be identified

- channels open with them all through the project.
- We identified all the ponds and de-silted them up to 2 m. Lots of solid wastes and liquid wastes are generated in villages. So we conducted a lot of awareness programs in the villages and started solid waste collection. Organic wastes were composted in small decentralized compost units established in the villages, and the compost had a lot of agricultural demand because of its high nutrient value and absence of any chemicals.
- We also provided toilet-cum-bathroom because the ladies were not comfortable without a bathroom, and provided water supply to them.
- The salinity problem was there. During rainy seasons open wells give good quality water, but in summer salinity increases. To provide something sustainable, we identified aquifers with about 400-500 TDS, and provided tube wells. Their yield was very good, and we provided water supply lines and also connected them to each toilet.
- Wastewater management should go hand in hand with water supply. So we collected the well samples in different seasons, yearly four times, and found groundwater samples to have very high faecal coliforms of 800 to few thousands, and also high COD, BOD and ammonia levels. These contaminants were obviously coming from human wastes or animal waste even into 200 meter deep groundwater because the geology of that location is fractured and weathered rocks. So septic tanks were made water-proof.
- Lots of grey water is also generated. We collected all grey waters from kitchens, bathrooms and septic tanks, and wherever space was available we put up constructed wetlands and led the wastewater into the wetlands, with suitable fodder plants being used in the wetlands. The villagers themselves cut the plants periodically to use them as cattle fodder. And whatever water comes out of constructed wetlands, it is transferred by solar pumps to irrigate the vegetable fields.

Delivering Jal Jeevan Mission in Synergy with River Restoring and Conservation Activities in Rural India- Beyond Ganga Rejuvenation

Venkatesh Dutta, BBAU, Lucknow

- The sustainability of water resources in heavily populated arid to semi-arid areas is often at risk, requiring inter-basin water transfer. The carrying capacity and bio-capacity of river systems need to be assessed. How can sustainable water supply for rural areas be ensured without inter-sectoral water conflicts or water transfer?
- About 85% of the fresh water demand is for agriculture. To reduce it, precision- and micro-irrigation are recommended. But what happens after tilling? If pipelines are laid in root zones, it is difficult for farmers to go for the next cropping. And after five years all the nozzles are clogged and the instruments are not working. What's the solution?



Shyam Prasad, Clean Water Dynamics

There is a NITI Aayog report that came out around 2015-16, according to which about 90% of our surface water resources are unfit for human use due to very high coliform levels. With elaborate rural water supply systems drawing water from distant sources a lot of black water will be generated, which will go into ponds, groundwater, open wells, etc., and everything will get contaminated within 4-5 years. But if a wastewater collection system is provided, then that alone will be more expensive than the water supply system. That is a crucial point to be kept in mind.

Brajesh Kumar Dubey, IIT Kharagpur

I would like to know from the state representatives their thoughts on:

- The success of SBM in your area and the long-term plan for maintaining the toilets? Because from anecdotal information that is coming many of the toilets are actually failing, and that may lead to localized shallow groundwater contamination as well.
- What community engagement models were used and how they have been successful?
- How are animal wastes and human consumption wastes like food and plastic wastes being managed in rural areas. What are their impacts on the water resources/ water quality?



Somnath Ghosal, IIT Kharagpur

Presented a video on a rural drinking water project conducted by him. The salient features that came out through the discussions are:

- The project cost depends on the raw water quality. We don't want to follow any stereotype kind of purification system. We just remove those excess harmful things present in the raw water. Hence we decide the type of filters needed and make use of the natural elevation, gravitational force, etc. to minimize the pumps and pumping costs.
- We don't need RO water because it can cause mineral deficiency. We remove only what is excess, like fluoride, arsenic, or salinity, through sand filters, activated carbon filters, etc.

BS Murty, IIT Madras

- The projects presented are self-sufficient in that people are managing them on their own.
- It is important to discuss with villagers about their thought process and activities, and ask for their cooperation. Because without their cooperation, nothing is going to fly.



Delivering Jal Jeevan Mission in Synergy with River Restoring and Conservation Activities in Rural India- Beyond Ganga Rejuvenation

DISCOURSES AND DELIBERATIONS

The state presentations focussed on the management/ governance and technological measures underlying the success of rural water supply and sanitation programs and on some broader problems of water resources in the respective states than on specific sustainability and local appropriateness facets of rural water management. Overall, they brought to fore some relevant issues that need greater attention and creative approach. The lead discussants and other experts brought out a medley of assorted rural water and waste management issues, with examples from various States, and deliberated upon critical issues that came up.

Several comments and opinions that emerged from the above discussions

were widely appreciated and approved by the delegates. The broad consensus on resolving the key issues highlighted in the Track are summarised as follows:

How can rural economies develop a unified water resource system by integrating rivers, drains, ponds, lakes, reservoirs and aquifers into a unified water resource system?

- All local water resources units from ponds, wells, springs, rivers, lakes and groundwater must be identified, mapped, revived, and their interconnections assessed and re-established where needed.

What are the challenges in managing black and grey water in rural settings and how are these challenges being met?

- The identification of black water and



grey water generation sources and amounts must be first determined.

- Each type of wastewater needs to be treated suitably. For black waters treatment by septic tanks and subsequently with grey waters, and for grey waters treatment by constructed wetlands and other easily manageable processes needed. The treated water and other resources generated should be used locally where possible.

What are the main lessons learnt from the experiences of rural water and sanitation managers on the implementation of toilets for the "open defecation free" initiative?

- Rural water policy is very ad hoc, and the rural sanitation drive was affected by it's disconnect from rural water supply.
- Rural water supply should be managed in an integrated manner over a geographical area, and not in terms of individual projects.
- Local communities must share in the decision-making and management of water-wastewater infrastructure along with training in maintaining their local water and wastewater

management systems.

- Traditional knowledge, beliefs and practices must be combined with modern scientific knowledge to ensure sustainability of water and other natural resources as shown by the successful experiences of West Europe and North America.
- Local water quality monitoring is a must, and a comprehensive water quality monitoring plan and infrastructure must be established.

How are animal wastes and human consumption wastes (such as food and plastics) being managed in the context of water resources?

- No specific recommendations, though the need was emphasized by all.

What community engagement models for rural water management has been successful and how?

- Taking local communities into confidence and discussing their needs and proposed solutions in advance is an absolute must.
- Letting local communities decide and implement projects for their needs and their local and traditional knowledge must be promoted.



SESSION

P3

THEMES

- Highlights of Tracks

DAY3:

Saturday, December 7, 2019
14:30 – 16:00 h

VENUE:

Hall 5, Vigyan Bhawan,
New Delhi

CHIEF GUEST:

SK Jha [Minister for Water Resources,
Government of Bihar]

MODERATOR:

Vinod Tare [Head, cGanga, IITK]

SPEAKERS ON DAIS:

Rajiv Ranjan Mishra [DG, NMCG,
Ministry of Jal Shakti]
SK Ratho [DDG, NMCG, Ministry of
Jal Shakti]

TRACK PRESENTATION:

Session P & Track A:

Vinod Tare [Head, cGanga, IITK]

Track B:

Rozy Agarwal [ED Finance, NMCG]
Sanmit Ahuja [Expert, cGanga, IITK]

Track C:

Mohammad Jawed [cGanga, IITG]
Sundeep Singh Chauhan [Expert, cGanga, IITK]

Track D:

Raj Bhattarai [cGanga, IITK]
Subrata Hait [cGanga, IITP]

Track E:

Indumathi M Nambi [cGanga, IITM]

VALEDICTORY SESSION



Valedictory Session

Highlights of Tracks

Session P & Track A

Vinod Tare, Professor & Founding Head - cGanga

THESE days children find using electronic gadgets more convenient than books. So we thought that whatever knowledge about rivers and Ganga we have, we should tell our next generation – our students as well as our teachers. So cGanga has taken up an activity to prepare scientific material for students and teachers of various levels from Class 1 onwards to higher education level and for common people. Hopefully, in the next 2-3 years we will be able to create

substantial material which should also get embedded in our educational curriculum at various levels. Its time to sensitize children and people and give them proper knowledge about the science of water and the science of rivers, so that right from their childhood the new generation understands the importance of rivers, what rivers can do to them and what they should be doing for the rivers. Thus, the Plenary Session prior to the Inaugural Session focused on these aspects.

Coming to Track A, where we talked about Science and Policy of River Restoration and how we will relate that to the present thinking of water to every household through the Jal Jeevan Mission. River restoration and Jal Jeevan Mission are essentially two sides of the same coin, and we need to bring in science into policy. But when we bring science into policy, it is not just the science but wisdom that also has to come in. So with whatever scientific knowledge that exists traditional wisdom and modern understanding have to be combined together and brought into the policy framework for the restoration

and conservation of rivers as well as for delivering on the Jal Jeevan Mission.

In Track A we discussed various aspects of the document we have produced – a short and concise manual for river restoration. It is a step-by-step procedure based on our assessment that if we want to restore a big river, we cannot go directly for restoring the highest order river. And Ganga is a high order river, we have to start restoration and conservation works from lower order rivers.

Scientifically viewing, Ganga is the agglomeration of thousands of streams





originating from various places, and ultimately that is what makes the body of main Ganga. So, we have to really look at all the tributaries to start with, whether it is the Kanh River which originates from the southern part of the Ganga Basin, or a number of rivers coming from the Nepal side, and so on.

We deliberated on why river restoration and conservation can't be a purely government programme. And, such programmes, then have to be a permanent kind of programmes, not like the time-bound Ganga Action Plan I or Ganga Action Plan II programmes. They must be part and parcel of our planned activity, and there should be a continuous planned budget available

for restoration and conservation of rivers and water bodies.

We will have to give the responsibility of restoring the river to the local or lower order River Basin Organization, so local organizations take care of their own streams. And they have to be empowered with all the knowledge required, knowledge related to biological, geo-chemical, and physical aspects of the river, and knowledge related to policies, laws and governance at the local level, state level or at the central level.

The second important thing, which we do not often talk about, is socio-economic and socio-

cultural aspects of rivers. When we want to restore a river, obviously there are conflicting interests that are involved when we talk about river water sharing. And those conflicting interests can only be resolved when we develop good understanding and communicate that understanding to the people. Only then people start discussing, negotiating and then sharing the responsibilities as well as the resources.

We also deliberated at great length about standards and norms, about why they have to be fitted to local circumstances. Whether there are standards for treatment of sewage or standards for what kind of river space utilization and what kind of hydraulic

structures to be built, they have to be commensurate with local requirements and not necessarily follow the top down approach or prescription.

We also have to make sure that our financial outlay for river restoration programs is broadened. Right now, we are spending about 20,000 crores in Namami Gange Program or smaller amounts in various other programs, but the outlay has to be several folds of that. Only then we will achieve the results. How do we broaden the contribution of water and river in our overall GDP? That contribution has to be increased, and only then the overall outlay for water and river restoration will increase and that will make the program sustainable.

Track B

Rozy Agarwal, ED Finance, NMCG

RIVER RESTORATION
and Jal Jeevan Mission are essentially two sides of the same coin,
and we need to bring in science into policy



WITH friends and experts from the finance sector, investors community, people from the banking side, and also some technology partners and service providers, we began with “What is public finance? And how is public finance supporting the Namami Gange Programme?” The panelists also talked about the need for capital, and whether adequate capital is available or not. A lot of capital seems to be available across the public system and also the private side. Our challenge is to channelize this finance or capital into projects of national importance like Ganga Rejuvenation.

A lot of suggestions came from various panelists on Blended Finance – whether it’s private finance or public finance, Ganga Bonds, and other kinds of financial instruments. We already have experimented in Namami Gange by a model called HAM, Hybrid Annuity based Public Private Partnership Model, which is basically a blended finance kind of an approach. We also felt the need to attract International Capital or International Investments – specially the pension funds.

As of now there appear to be some

apprehension, some fear in the minds of banking community to lend to Ganga Rejuvenation programs and projects which need to be allayed. There is a need for all of us to instill confidence in the banking community to come forward and lend their support to Ganga Rejuvenation.

Another concern which was raised, especially from CSR prospective and taken up by some friends from the CSR platform, was making water a priority sector for lending. In fact CSR funding for Ganga Rejuvenation has not been much, and its only few and far between. Taking up

projects on Ganga Rejuvenation is listed as one of the activities under Schedule 6 and 7 of the Company’s Act, and I requested them to come forward to help us in Ganga Rejuvenation projects.

One panelist gave us the perspective on how the municipal corporations are handling the urban waste management and urban water management. It was an eye opener for us that unless they shift over from cash accounting system to an accrual accounting system, they would not know what their balance sheet speaks, what their liabilities and assets are.

Track B

Sanmit Ahuja, Expert, cGanga, IITK

WE have to broaden the financing horizon, Rs. 20,000 crores is not going to cut it, we need Rs. 7 lakhs to 10 lakhs crores capital, and the only way to do that is by tapping into institutional money, pension funds, insurance funds, sovereign wealth funds, and hence moving towards the bond markets. If we don't create listed tradable securities, we will not be able to tap that money. On the supply side, pricing of water, essentially creating revenue streams out of water, is a prerequisite for us to move towards the bond markets.

Blended Finance is finance coming from public or impact money – who want higher returns on economic developments – measured by IRR (Internal Rate of Return) and finance coming from commercial investors and lenders – who want higher return on investments – measured by DRR (Developmental Rate of Return). Hence developmental investors – government included – should make capital allocation in taking the risk out. Where there is revenue model available those projects are easily financed, but we explored the financing options when there is no revenue model available or there are indirect revenue streams.

The stage is set to issue the first major river bond in the world, in the developing world coming out of India. We will start structuring and working on Ganga Bond in the next few weeks and months to come and we have already done a few International roadshows. Fintech, as an investment category, is emerging very fast and we had a



very interesting session on how new digital technologies in the finance sector can also help in raising capital.

One presentation was for water reuse certificates which, much like carbon credits or new bill purchase obligations, incentivizes people who recycle and reuse so that they get certificates which can freely trade in the market and generate more capital. We also

THE STAGE IS
set to issue the first major river bond “Ganga Bond” in the developing world coming out of India

looked at how insurance is very essential, hence how digital platforms can be used for bringing insurance around water security, floods or other disasters and water recycling and treatment.

Finally, we touched up on a technology for creating waste trading platforms, and I am told that mutual funds are already being processed to fund any kind of security

listed on the stock exchanges.

Another specific point someone mentioned is to bring in certified Water Auditors much like Energy Auditors. Also, as Mr. Agarwal mentioned, we really have to focus on getting water listed as priority sector lending subject because right now it is lumped under the infrastructure category where lending has become strained by poor performance of the power sector.

Track C

Mohammad Jawed, cGanga, IITG

WE are looking for technologies which are going to be effective for river rejuvenation or management of water either independently or in an integrated form. We do not bind ourselves to only indigenous technology, we are open to technologies established outside. But what we are very keen on is that any technology from outside must be functional in our conditions also.

For Environmental Technology Verification (ETV) we had almost 17 companies, mostly coming from abroad with Indian collaboration, to make their presentations. About 3-4 interesting presentations were there for Bio-engineering and Bioremediation processes for reclamation of water and soil, and another 3-4 presentations were there for energy production using anaerobic technology.

There was one proposal to collect plastics, which otherwise end up in water bodies, for their commercial value as a resource. Another interesting proposal came on using waste water within city limits for cooling and heating of buildings.

Some software applications – like mobile apps – were also presented. One of them was a good app for efficient water use in agriculture wherein based on land information, weather information, cropping pattern, etc., one can readily get the timings and quantities of irrigation water to apply. Similarly, a few applications also came on hydrological telemetry system for drought assessment, and another presentation on Hydrological data processing and forecasting system for drought management.

A few presentations were also there for MoUs for ETV already signed on the first day of the summit including containerized ETP by GVS Solutions (Spain), Tyre and Plastics recycling by Exocubic (UK), Waste to Energy by Boson Energy (Luxemburg), and UV disinfection by TrojanUV (Canada).

There was also a presentation on how to take care of stagnant wastewaters in drains and ponds by using floating plants system, and they

have shown that in Indian conditions like Kolkata how they were able to rejuvenate some canal waters. Similarly, a lot of ash is dumped at ash ponds in thermal power plants. They have shown how to make it green and reclaim the soil.

There was another interesting system presented for treating waste water of a part of Bengaluru city and they are using it to rejuvenate a lake.

There was another important presentation of application of Electro dialysis to recover

materials – not only to produce desalinated water from sea water but also to recover valuable materials.

I found the audience – including people from Jal Board, from Pollution Control Boards, and from State Government Departments – very keen to ask questions and clarifications. People want to find solutions to tackle the many pollution problems of soil, air, water, plastics, and solids. In the last one year I think this awareness in our thinking has grown tremendously.

EVOLVING FINANCING
strategies are very crucial for implementing solutions presented in Track C. Some aspects have already been discussed in Track B. Thus it is important that deliberations of Track B and Track C, and the followups, are seen in conjunction



Track C

Sundeep Singh Chauhan, Expert, cGanga, IITK

INDIA IS A HUMONGOUS

market but would be used as a springboard to
global business

THERE was a lot of presentations on IoT, Data, Digital Solutions, etc. In ISRO, some of our data – especially on agriculture – is very sophisticated. Unless you work with the government, there are complaints of accessing data owned by NIC in India, but there is a way of working on that data.

India is a humongous market but I would suggest that you use India as a springboard to global business. “Make in India” is our flagship programme, so in some of the technologies we should try and use India’s expertise, not only for the Indian market but also for markets globally. Already companies in manufacturing, next generation of material science, deep data, artificial intelligence, and machine learning have more than 2 million people working in India.

In the water sector the biggest problem is with O&M which most companies are struggling with because once the plant is built there are not enough trained O&M guys. We have discussed that it’s not a great career prospect for guys who spent 4 years in a sewage treatment plant. So, we will have to use technology as we do in Europe etc.



Track D

Raj Bhattarai, cGanga, IITK

WATER TARIFF SHOULD

not just reflect the cost of supplying water but should reflect the scarcity value of water

WE had a really lively and spirited discussion. It was amazing to see such brilliant ideas coming from the panelists and then from the general audience.

Two important points they made were that our answers to the questions raised here should be based on the quantifiable studies instead of personal opinions and that the trust and reliability is really critical for the water sector. If we don't provide reliable water supply or reliable water quality then the trust is broken, and when the trust is broken it will take a long time to re-establish that trust. And if we don't provide good quality water then everybody has to treat the water at the point of use at every home. If you pool all that money you could have a first-class public water supply system.

Water issues are local. So local control, management and governance are really critical, and of course water pricing is important to encourage conservation. We had presentations from five cities in this track from Nashik, Faridabad, Indore, Singapore and Varanasi.

And then our friend from Singapore, he made a really good point about water tariff. Water tariff should not just reflect the cost of supplying water but it should reflect the scarcity value of water. Because water is scarce or going to



Track D

be scarce as the population increases and industrial growth increases, the demand increases. So, water tariff should include the scarcity value of water.

While pricing the water we should also not forget that Water Equity that must be considered for smart water planning. So we have to make sure the basic supply of water for the poor are easily available. The pricing should reflect that.

Specific Issues Raised by IWIS Organising Team:

How are our cities creating new water resources by integrating rivers, drains, ponds and lakes into a unified resource system? I think cGanga is encouraging that, and we are pioneering that effort to start using integrated water resource planning. Then the sustainability of water resource is extremely critical and proper land use planning requires

dedicating a certain percentage of area for water bodies, so you maintain natural water bodies and natural flow not just for the aesthetic purpose but for the recharging the groundwater and valuing nature.

Second question was whether 24x7 water supply is a boon or bane for water resource management. It is a worthy goal, but should be implemented only after water leaks have been reduced to an acceptable low level and proper water tariffs have been implemented to encourage conservation. So the question is really between reliable water supply and reliable water quality versus significant water loss for supplying 24x7 water.

Thirdly, how are our cities increasing water revenue and reducing water losses? Some use leak detection sensors and some are using remote sensing. A suggestion that came up frequently was



doing two stage monitoring – at the community level and then also at individual residential unit level. Once you start metering at the individual level then there will be inducement for conservation, so that's really critical. With community level metering, we aggregate individual resident metering and compare and find out where the losses might be.

Is the dual pipeline strategy with different water quality and water use helping or hindering water resource management? There was a long discussion on centralized versus decentralized water system. Decentralized systems are preferable but the decision should be made on a case-by-case basis depending upon site specific conditions. For dense city cores, it may be difficult to put a decentralized system, so we need centralized system for them. But for new, developing areas, decentralized systems should definitely be considered. So, instead of a completely close

loop reuse system using dual pipeline, there should be discharge of treated wastewater into natural and artificial water bodies, streams and wetlands and integrate with the recycling system because continuous close loop recycling is technically limited.

For preparation of Urban River Management Plans, there is piecemeal work but we need more integrated water resource management planning. The sustainability of water resource management is critical – we really should never forget that.

Last but not least, despite numerous occurrences, the urban areas are not yet ready to face drought related natural disasters. Work is needed to create resilient systems to handle natural disasters, whether it is extreme drought or extreme flood, and we are seeing more and more extreme events thanks to climate change. We really need to prepare ourselves in a resilient way.

Track E

Indumathi M Nambi, cGanga, IITM



THE session highlighted the key issue of holistic approach to the Jal Jeevan Mission centered around the identification of water sources, the quality of sources, and the backend developments – questions on where the used water is finally going and how.

The first state government presentation by Mr. Indu Bhushan Kumar, Water Resources Department, Govt. of Bihar, was on integrated water resource management and some linkages to rural water supply. Some specific issues focused on are:

- Gaps in irrigation and water shortages and excesses in different regions, and hence the need for inter-basin water transfer that are being carried out.
- The need to review river E-Flows proposed by NMCG in view of the water shortages.
- Water quality problems of water bodies due to excessive algal growth and microbial contamination.
- Large investments by the state government to rejuvenate the myriad water sources including 1 lakh ponds and 3 lakh wells.

The Odisha government presentation by Ms. Roopa Mishra, Addl. Secretary in Panchayati Raj Department, brought out the following key points:

- Confidence to meet the Jal Jeevan Mission target by 2024, and moreover with

a targeted supply of 70 LPCD instead of the prescribed 55 LPCD.

- The problems due to Odisha's poor infrastructural development, far-flung rural pockets, and groundwater salinity, are being tackled resolutely.
- The safe management of the wastewater to be generated from the large-scale rural water supply needs to be addressed immediately.
- Odisha, with many industries like mining coming up in rural areas, faces the problem of toxic metal pollution and not just fecal or microbial contamination of its water bodies, and this also needs to be addressed.

The 3rd session of discussions and presentations brought to focus many issues of concern through intense discussions and debate, especially:

- Community engagement in rural water supply and management is strongly needed along with revival of local and traditional knowledge.
- Low-cost India-centric innovations and training of plumbers, electricians and mechanics should be ramped up to ensure appropriate and sustainable rural infrastructure and generate rural employment.
- The experience of Swachh Bharat Mission should be utilized for holistic execution of the Jal Jeevan Mission.

WATER EQUITY
must be considered for smart water planning

Closing Speeches

Rajiv Ranjan Mishra, DG, NMCG, Ministry of Jal Shakti

MR. Ratho rightly said that our Smart Cities Program is basically a Smart Localities Program and not a whole city-wise program.

The presentation by PUB representative had brought out some interesting aspects very clearly, which I recount here for their importance:

- Given political will, the governance and integration will come out right.
- Capture every drop of freshwater, especially since rainfall in India is concentrated during the monsoons and erratic due to climate change.
- Collect every drop of freshwater and reuse through different technologies.
- Diversify water sources – including desalination, recycled water and imported water. Hence, simply laying pipelines to get water from distant sources is not proper urban planning.
- Provide no free or subsidized water supply – but this may not be possible in the Indian context.

River rejuvenation must take into account groundwater – the source of river baseflows – and not just surface water.

We need more frequent Technology and Innovation sessions – not just once a year in IWIS.

As Mr. Sanmit Ahuja said, we need to pool in a lot of money and not depend on just government funds. We have had some success with the Hybrid Annuity Model, but we have to also look at other revenue models.

The Smart Cities discussion session brought out the need for long-term policy making rather than piecemeal efforts. So urban planning must take into account the peri-urban growth which will get inducted into municipal areas in due time.

The session on Jal Jeevan Mission brought out the importance of ensuring sustainable and healthy water sources for its success. So reliability and quality of the water sources are crucial.

24x7 WATER SUPPLY
is a boon or bane for water resource management. It is a worthy goal, but should be implemented only after water leaks have been reduced to an acceptable low level and proper water tariffs have been implemented to encourage conservation



A rejuvenated Ganga and water bodies are very important for the success of the Jal Jeevan Mission. But we do not want to ban fishing in Ganga because the livelihoods of many families depend on it.

Like the tourism and recreational activities I observed in Europe, there is a lot of revenue-generating potential of River Ganga like boating and river cruises.

Most of our river floodplains are ruined not only by common people but by the government system.

Sometimes, even municipalities dump garbage on the floodplains or directly into the Ganga.

As suggested from the audience, it is a good idea to prepare and present a comprehensive document on the state of River Ganga – the flows and water quality near various cities, etc. – and what we really expect Ganga to be apart from being a cultural heritage. And it will be good idea to include a session in IWIS on the different components of Namami Gange and what we have been doing.

Sanjay Kumar Jha, Minister, Water Resources
Department, Government of Bihar



IT is very encouraging to note that over 1000 international and national experts have been engaged in intense discussions during IWIS 2019.

When Jharkhand state was carved out of Bihar, our state was left with only 0.5% forest cover, but through dedicated effort this has now increased to 15%.

Besides rejuvenating our traditional water bodies like Ahars and Pynes, we are also focusing on developing solar power and

educating farmers on crop rotation for water conservation.

We are also promoting treated effluent use for irrigation, river interlinking projects, water conservation, and flood mitigation.

Rampant withdrawal of Ganga waters by upper riparian state has depleted the Ganga river flows in Bihar. This, coupled with faulty design of the Farakka Barrage, has led to river siltation, causing increased floods in Bihar.

Sanmit Ahuja, Expert, cGanga, IITK

EARLIER we did not have the capacity for large-scale organized activity. But now we have both the capacity and the structure. The working groups are now merging into three knowledge hubs – circular economy, data and information, and water finance – that have been launched. Our reports can be downloaded from the website, and interested people can join these knowledge hubs and contribute their knowledge.

**RIVER
REJUVENATION**
must take into account
groundwater – the source of
river baseflows – and not just
surface water









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