सत्यमेव जयते
Government of India

9th India Water Impact Summit (IWIS)

Valuing Water | Transforming Ganga

DECEMBER 4-6, 2024

New Delhi

2nd Climate Investments Technology Impact Summit (CITIS)

First-of-a-kind (FOAK) as an Asset Class, Nth-of-a-kind (NOAK) as the Scaling Model

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

NITI Aayog
National Institution for Transforming India

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

A CONSOLIDATED REPORT ON

9th India Water Impact Summit (IWIS)

Valuing Water | Transforming Ganga

&

2nd Climate Investments Technology Impact Summit (CITIS)

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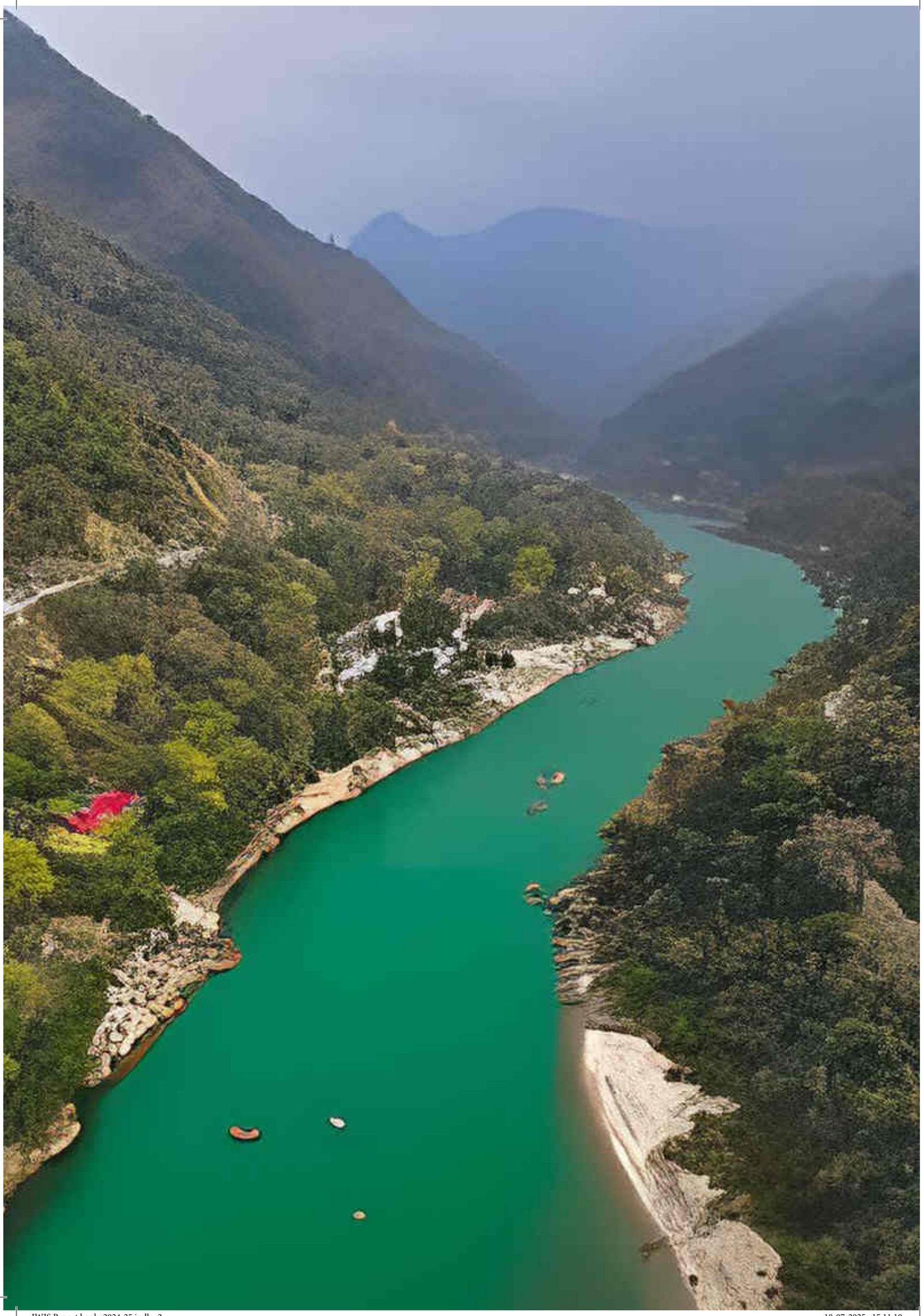
04th - 06th DECEMBER 2024

Bharat Mandapam – Convention Centre
New Delhi



सत्यमेव जयते

जल शक्ति मंत्री
भारत सरकार

Minister for Jal Shakti
Government of India

MESSAGE

I am greatly pleased to learn that "India Water Impact Summit – 2024" and "Climate Investments and Technology Impact Summit – 2024" (IWIS+CITIS-2024) are being organised by National Mission for Clean Ganga (NMCG), Centre for Ganga River Basin Management and Studies (cGanga), and Niti Aayog in New Delhi for many national and global specialists, academicians, technology innovators and investors to discuss a wide range of issues pertaining to *"River Rejuvenation and Conservation: Learning from the Past and Strategizing for the Future"* over a 3-day brainstorming period.

Since the last decade our government has focussed on rapid development with social and environmental inclusiveness. We have thus made enormous progress in transforming India into a developed country centred around "Atmanirbharta" as our core value. In this direction, India's flagship Namami Gange programme launched under the visionary leadership of Hon'ble Prime Minister Shri Narendra Modi a decade ago has proved to be remarkably successful in terms of the Ganga River's cleanliness and biodiversity improvements. The cleanliness drive is best exemplified by our long-term Hybrid Annuity Model (HAM) based PPP schemes of Sewage Treatment Plants in dozens of cities of the Ganga Basin, while our biodiversity revival efforts include many pioneering efforts such as protected zones and other ecological measures for iconic Ganga river species like mahseer, dolphins, gharials and turtles as well as dolphin-monitoring programmes. On the other hand, our socially all-inclusive *Swachh Bharat* and *Jal Jeevan Missions* have paved the way for healthy and secure lives of our rural and urban masses.

I am pleased to note that IWIS+CITIS-2024 will delve into many aspects for improving our River Rejuvenation and Conservation efforts, our water management to overcome many challenges, technological innovations, and financing strategies. I hope that the recommendations and positive ideas emerging from these discussions can be put to ready use in designing and refining our government's efforts. Towards this end, the Centre for Six River Basin Management Studies proposed in 2019 and now set up in NRCD with multi-institutional participation is also a promising start. I wish NMCG, cGanga and Niti Aayog a very successful IWIS+CITIS-2024, and look forward to its valuable outcome.

27 November 2024

C R Paatil

सत्यमेव जयते

जल शक्ति राज्य मंत्री
भारत सरकार, नई दिल्ली

Minister of State for Jal Shakti
Government of India, New Delhi

MESSAGE

I am very happy to note that the "India Water Impact Summit – 2024" and "Climate Investments and Technology Impact Summit – 2024" (IWIS+CITIS-2024) are being organised in parallel by National Mission for Clean Ganga (NMCG), Centre for Ganga River Basin Management and Studies (cGanga), and Niti Aayog in December 2024 for reputed experts, technologists, innovators and finance experts to brainstorm over *"River Rejuvenation and Conservation: Learning from the Past and Strategizing for the Future"*.

In the last 10 years India has made rapid progress in its development trajectory, with economic growth, social inclusion, and holistic environment being our government's synchronized priorities to fulfil our Prime Minister's dream of creating Viksit Bharat by the time we celebrate our hundredth year of independence. Like several arms of the government, the Jal Shakti ministry, too, has remained committed in this drive by ensuring our country's progress on the strength of our sophisticated water resource management techniques.

Thus our water resources – rivers, lakes, groundwater, etc. – are in much better conditions today, allowing us to make full use of their multiple benefits from irrigation, municipal and rural water supplies to industrial use, fisheries, hydropower generation, tourism, and inland waterways' transport. And, of course, our rivers and waterbodies are in much better condition today due to our holistic initiatives on municipal and industrial pollution control and managing water inflows and outflows. The success of these measures are well reflected in common people thronging rivers and riverside gatherings today for pilgrimage, recreation, tourism and culture. If one issue still looms as a challenge, it is the possible impact of Climate Change on our rivers and freshwater systems and how best to tackle them.

I am happy to note that the twin Summits will focus on strengthening River Restoration and Conservation through various science & technology measures, policy reviews, and legal and financial considerations, and on technology pitches in water, energy, waste, transport, and food & agriculture sectors. I wish the organisers of IWIS+CITIS-2024 every success, and look forward to their outcomes.

Raj Bhushan Choudhary

26 November 2024

Raj Bhushan Choudhary

सत्यमेव जयते

राज्य मंत्री जल शक्ति एवं रेलवे मंत्रालय

Minister of State Jal Shakti and Railways
Government of India

MESSAGE

It gives me great pleasure to know that the twin Summits – India Water Impact Summit and Climate Investments and Technology Impact Summit (IWIS+CITIS-2024) – are being jointly organised in December this year by the National Mission for Clean Ganga (NMCG), Centre for Ganga River Basin Management and Studies (cGanga), and Niti Aayog to deliberate on “River Rejuvenation and Conservation: Learning from the Past and Strategizing for the Future" by Indian and foreign experts, government representatives, academicians, technologists and financiers.

Over the last ten years we have progressed steadily in developing secure water management in India. This has helped our remarkable progress in agricultural, industrial, livelihoods, healthcare, tourism and other sectors. Our rivers, lakes, wetlands, maritime zones, forests and other natural resources have also prospered through an integrated conservation approach that owes its success first and foremost to our visionary leader and Prime Minister Sri Narendra Modi. Our government’s efforts today are oriented to securing a more stable and eco-friendly urban and rural environment that will fully meet not only our developmental pressures but also the exigencies arising out of climate change.

I am pleased that IWIS+CITIS-2024 will deliberate in depth upon various issues pertaining to our river conservation initiatives as well as no emerging challenges in water management in the country. And, as in past summits, innovative new technologies will be explored to meet the water-related challenges of climate change, at least some of which ought to be infused in India in the near future. I wish NMCG, cGanga and NITI Aayog very successful summits, and look forward to the positive solutions that emerge for our Water Management strategies.

22 November 2024

V Somanna

Preface

VINOD TARE
Former Professor, Founder & Advisor
Centre for Ganga River Basin Management & Studies (cGanga),
Indian Institute of Technology Kanpur

RAJEEV KUMAR MITAL
Director General
National Mission for Clean Ganga (NMCG),
Ministry of Jal Shakti, GoI

On behalf of the Centre for Ganga River Basin Management and Studies (cGanga) led by IIT Kanpur, National Mission for Clean Ganga (NMCG), National River Conservation Directorate (NRCD) and NITI Aayog, we warmly welcome all participants from India and abroad to the twin summits, **9th India Water Impact Summit and 2nd Climate Investment and Technology Innovation Summit (IWIS+CITIS-2024)**.

India Water Impact Summit, which was started as a one-time event over a decade ago, has now become an annual event organized jointly by NMCG and cGanga. In the 7th Edition of IWIS, NITI Aayog extended its support in organizing the event. In the 8th edition the twin summits including CITIS were also included in the G20 India events.

The Namami Gange programme, being implemented by NMCG, is an integrated mission for the restoration and conservation of River Ganga and its tributaries. Towards this goal, a strategic comprehensive Ganga River Basin Management Plan (GRBMP-2015) was developed by a consortium of 7 IITs, which is being further evolved by cGanga led by IIT Kanpur. cGanga acts in the capacity of a comprehensive think-tank to NMCG in its stated goals and objectives vis-à-vis the Ganga River Basin. Namami Gange aims to restore the wholesomeness of the river by ensuring Aviral Dhara and Nirmal Dhara, and maintaining its geomorphological and ecological integrity. Integrated River Basin Management (IRBM) approach is followed in Namami Gange with multi-sectoral and multi-agency interventions such as: (i) for pollution abatement (Nirmal Ganga), (ii) for improving river flows (Aviral Ganga) and ecology, (iii) to strengthen people's river connect (Jan Ganga), and (iv) to facilitate diversified research, scientific mapping, and evidence-based policy formulation (Gyan Ganga).

At the outset, a brief overview of the past **eight Summits** is outlined here to highlight the background to the present IWIS. The **1st Summit**, held in 2012 during preparation of the Ganga River Basin Management Plan (GRBMP) by the IIT Consortium, was an aggregate of the then prevailing activities on India's water resource management. The **2nd Summit**, held in 2017,

Namami Gange aims to restore the wholesomeness of the river by ensuring Aviral Dhara and Nirmal Dhara, and maintaining its geomorphological and ecological integrity. Integrated River Basin Management (IRBM) approach is followed in Namami Gange with multi-sectoral and multi-agency interventions such as: (i) for pollution abatement (Nirmal Ganga), (ii) for improving river flows (Aviral Ganga) and ecology, (iii) to strengthen people's river connect (Jan Ganga), and (iv) to facilitate diversified research, scientific mapping, and evidence-based policy formulation (Gyan Ganga).

attempted to establish a new multi-disciplinary, multi-stakeholder forum to bring together policy makers at national and regional levels, technology and engineering firms, finance and investment specialists, and interested civil society members to brainstorm on pressing issues of India's water environment. The Summit also created the Water Finance Forum. The **3rd Summit**, held in 2018, reviewed the manifold efforts undertaken by government agencies to meet Namami Gange's goals of rejuvenation and conservation of India's National River Ganga, especially in the critical Ganga Basin States – Bihar, Delhi, Uttarakhand, Uttar Pradesh, and West Bengal. The **4th Summit** held in 2019 went further to explore ways and means of integrating science and policy for Integrated Water Resource Management, to assess major water impacts in urban and rural India, and develop new and innovative financing mechanisms through the Water Finance Forum.

The ideas and suggestions that emerged from the above four Summits led us to seek comprehensive means to integrate river conservation into India's developmental trajectory in the **5th Summit** (IWIS-2020) from the perspective of Arth Ganga, an ancient Indian concept revived by our Hon'ble Prime Minister Sri Narendra Modi. IWIS-2020 also intensified efforts to synergize planners, executors, financiers, investors and regulatory bodies to financially strengthen water management and river conservation in India. The **6th Summit** (IWIS-2021) focussed specifically on different types of river resources, their contribution to ecosystem services for human benefit, and the adverse effects of over-extraction and misuse of these resources on these ecosystem services. The thrust of deliberations in the **7th Summit** (IWIS-2022) was to understand, elaborate and delineate potential causes of divergence in different activities carried out by different agencies & Govt. and formulate strategies for convergence of views and actions.

In the **8th Summit** (IWIS – 2023), which was twinned with the **1st Climate Investment and Technology Impact Summit (CITIS)**, the spotlight was on land, water and rivers as interdependent systems of nature, that is, Samarth Ganga and Productive Land, considered together in the context of the national initiative on Lifestyle for Environment. The central issues included: (i) Lifestyle for Farmland Productivity plus

To realize the vision of the Hon'ble President of India, as proclaimed in the Joint Parliament Session in June 2019, we are delighted to inform that CAMP – Condition Assessment and Management Plan studies for 6 river basins on the lines of Ganga River Basin – has been initiated with the establishment of cMahanadi, cNarmada, cGodavari, cKrishna, cCauvery, and cPeriyar involving 13 institutions under the overall leadership of cGanga

Management of STP Sludge & Municipal Solid Residues, and (ii) Lifestyle for Rivers in conjunction with recycle/ reuse of wastewater and the creation of a Water Market. On the other side, CITIS presented new technologies and applications being developed worldwide to improve India's river and land management scenario and threshed out special climate-related investments in water, energy, waste management, food, agriculture, and transport sectors.

As in the previous year, IWIS+CITIS-2024 will comprise the twin summits – IWIS and CITIS – to be held in parallel.

To realize the vision of the Hon'ble President of India, as proclaimed in the Joint Parliament Session in June 2019, we are delighted to inform that CAMP – Condition Assessment and Management Plan studies for 6 river basins on the lines of Ganga River Basin – has been initiated with the establishment of cMahanadi, cNarmada, cGodavari, cKrishna, cCauvery, and cPeriyar involving 13 institutions under the overall leadership of cGanga. We welcome NRCD and the 12 other institutions engaged in CAMP, namely IITs at Indore, Gandhinagar, Hyderabad and Palakkad, NITs at Raurkela, Raipur, Warangal, Surathkal, Trichi and Calicut, CSIR-NEERI at Nagpur, and IISc at Bangalore who have joined us in organising this IWIS & CITIS.

The focus of IWIS 2024 will be on delineating the approach, modalities, successes and bottlenecks of river rejuvenation and conservation efforts in India along with possible course correction and strategising for the future. IWIS will also brainstorm over several pressing water management issues in the country such as Environmental Flows, River Monitoring, Nature Based Wastewater Treatment Options, Closing the Water Loop at Appropriate Local Scale, Bio-profiling of River Spaces, and Management of STP Sludge and Municipal Waste Residues. On the other hand, in order to better meet not only present challenges but also the exigencies of climate change in particular, CITIS will explore new technologies and innovations for different sectors (that are pertinent for the water sector in India) and their value as asset classes.

In concluding, we thank our strategic partners, panellists, speakers, staff and volunteers who have worked hard and contributed enthusiastically to make these twin Summits a success. We hope that you find IWIS+CITIS-2024 to be as constructive and exciting as the previous Summits. We look forward to your valued participation in the proceedings.

TWIN SUMMITS AT A GLANCE

Day 1: Wednesday 4 December 2024

Time, hrs.	9th IWIS & 2nd CITIS Programme
0930 – 1100	Registration, Meet and Greet
1100 – 1130	Tea/Coffee Break
1130 – 1300	Inaugural Session of 9th IWIS
1300 – 1400	Lunch
1400 – 1530	Special Plenary Session: Indian Rivers – Similarities & the Peculiarities
1530 – 1600	Tea/Coffee Break
1600 – 1745	Inaugural Session of 2nd CITIS
1800 – 2000	Networking Reception

Day 2: Thursday 5 December 2024

Time, hrs.	9th India Water Impact Summit Track A: IWIS	Track B: Current Challenges	2nd Climate Investments and Technology Impact [CITIS] (Track C: Technology Pitches; Track D: CITIS)	
0930 – 1100	**Session A1:** Relevance & Robustness of the Indian Framework for River Conservation vis-à-vis Global Frameworks	**Session B1:** Environmental Flows-Implementation Challenges	**Session C1:** Technology Pitches I	**Session D1:** Investing in Water
1100 – 1130	Tea/Coffee Break			
1130 – 1300	**Session A2: Enablers for River Rejuvenation & Conservation [RRC] – I:** Science & Technology	**Session B2:** Challenges in Adopting Nature Based Wastewater Treatment Options	**Session C2:** Technology Pitches II	**Session D2:** Investing in Energy
1300 – 1400	Lunch			
1400 – 1530	**Session A3: Enablers for RRC – II:** Policy, Laws, Regulations & Governance	**Session B3:** River Monitoring - Real Time Sensor Based vis-à-vis Participative	**Session C3:** Technology Pitches III	**Session D3:** Investing in Waste and Circular Economy
1530 – 1600	Tea/Coffee Break			
1600 – 1745	**Session A4: Enablers for RRC – III:** Public Participation	**Session B4:** Strategy for Closing the Water Loop at Appropriate Local Scale	**Session C4:** Technology Pitches IV	**Session D4:** Investing in Agriculture
19:30 –22:30	Networking Reception & Dinner			

Day 3: Friday 6 December 2024

0930 – 1100	**Session A5: Enablers for RRC – IV:** Economics & Financing	**Session B5:** Bio-profiling of River Spaces – Reference, Present & Target Settings	**Session C5:** Technology Pitches V	**Session D5:** Free Networking Session
1100 – 1130	Tea/Coffee Break			
1130 – 1300	**Session A6:** Quantum and Efficacy of Essentials and Convergence Efforts for River Conservation	**Session B6:** Strategic & Revenue Gaps in Circular Economy of STP Sludges and Municipal Solid Residues	**Session C6:** Technology Pitches VI	**Session D6:** Investing in Digital Climate & Environmental Systems and Platforms
1300 – 1400	Lunch			
1400 – 1500	CITIS Valedictory Session			
1500 – 1600	IWIS Valedictory Session			
16:00	Closing Refreshments			

IWIS Sessions CITIS Sessions Common Networking Sessions

Note: All lunch and coffee breaks are common to both IWIS and CITIS participants

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PLENARY SESSION-CITIS

INDIA WATER IMPACT SUMMIT (IWIS)

Track A - IWIS 2024

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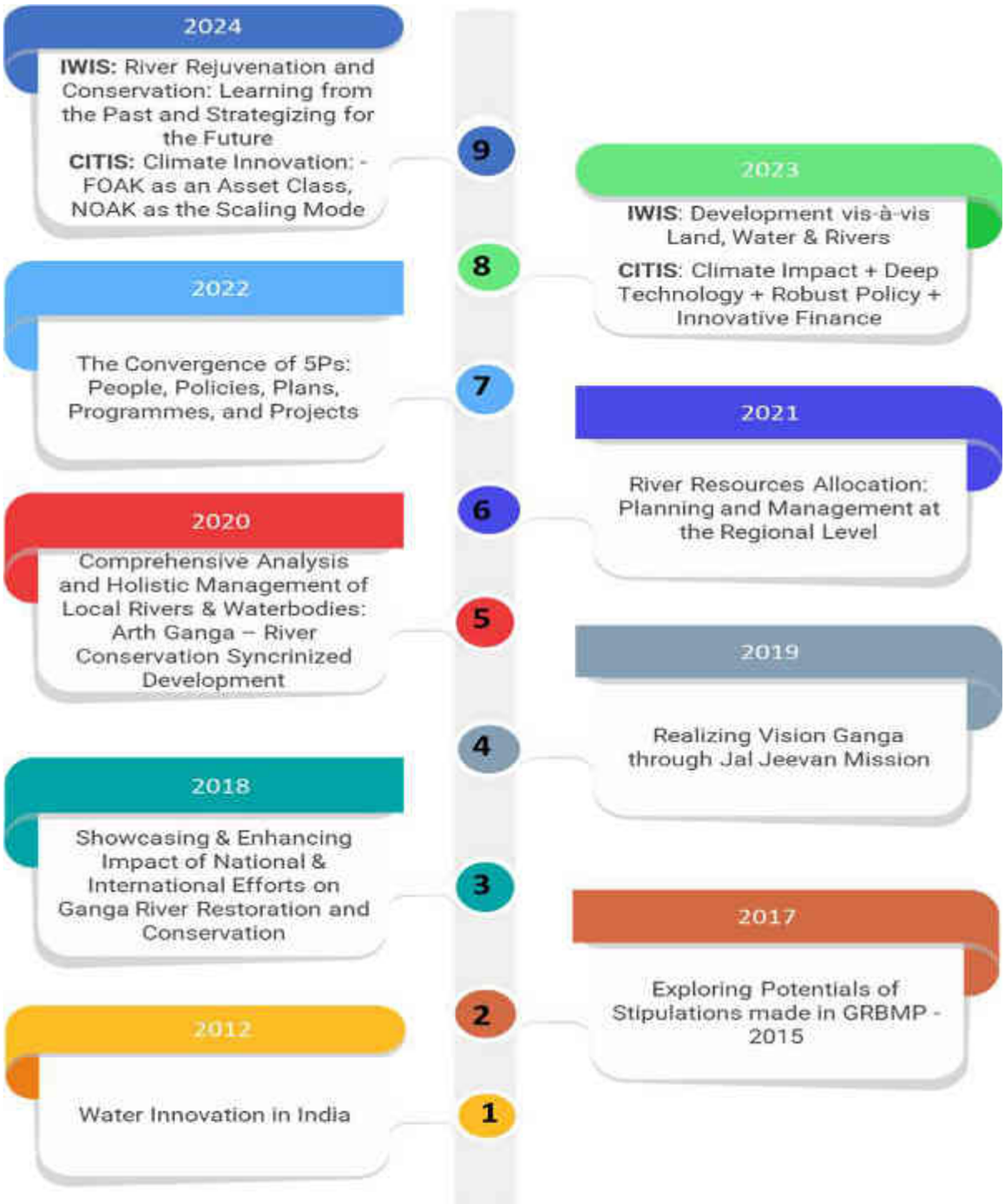
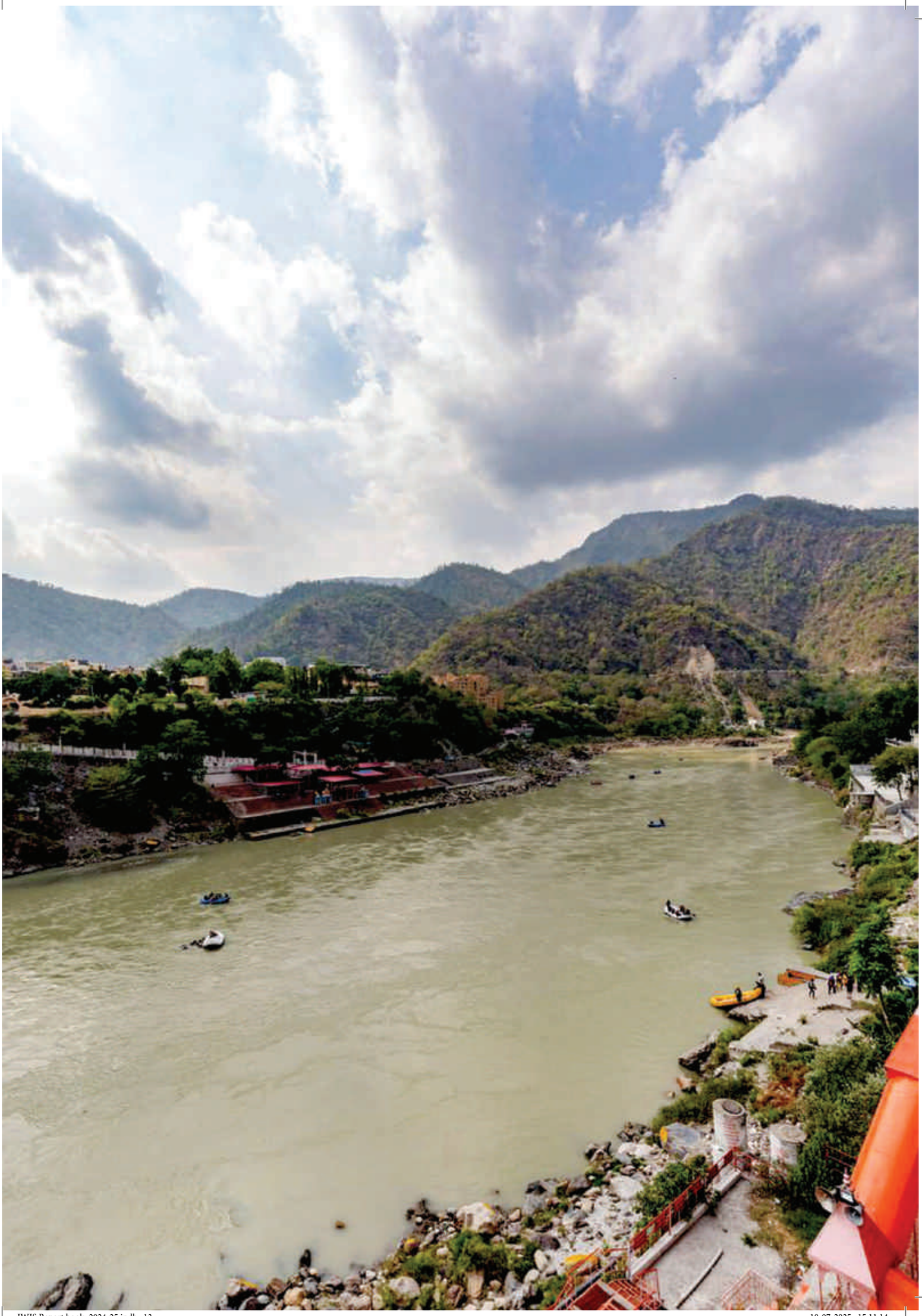
Themes of IWIS & CITIS at-a-Glance





River Rejuvenation and Conservation: Learning from the Past and Strategizing for the Future

The India Water Impact Summit (IWIS) was first launched in 2012 during the evolution of the Ganga River Basin Management Plan (GRBMP) by the Consortium of 7 Indian Institutes of Technology (IITs). It aimed to bring clarity to the myriad scientific, technological, socio-cultural, legal, policy and governance issues pertaining to river basin management in India in the context of highly diverse and divergent stakeholder interests, perceptions and understanding of river processes. On completion of the GRBMP in 2015, seven more Summits were held annually since 2017 to further probe the unclear or contentious issues and build consensus for scientific understanding, assessment of analytical tools, evaluating data requirements, implementation and monitoring mechanisms, policy interventions, synergy and convergence in government and private efforts, and adopting technological innovations for managing India's water environment holistically and economically.

IWIS has now turned out to be a much sought-after annual event wherein scientific experts, key stakeholders and government representatives discuss threadbare the dynamic challenges and opportunities in India's water and related sectors. Separate sessions are held to brainstorm over key science, technology and policy issues, elucidate the views of central and state governments, review new promising technologies, and synchronize the interests of technology providers financiers, economists, policy makers, and regulators to build a robust technological culture for comprehensive water management in India.

In consequence of the above initiatives, an imperative need has grown to incorporate climate change mitigation and adaptation for the water and environmental sector through technological innovations. Thus, the present Summit is a coupled system of twin summits – the India Water Impact Summit (IWIS) and the Climate Investment and Technology Impact Summit (CITIS), wherein the latter summit is streamlined to bind potential investors with technology providers after review and testing of new technologies and innovative business models, implementation of proven new technologies, adopting suitable financing mechanisms, and collaborating within multiple sectors such as energy, agriculture, urban management, transport, and infrastructure development that are intricately linked with climate, air, land, rivers and water management.

The 9th India Water Impact Summit (IWIS) has present an exhibition of past achievements of IWIS and hold intensive expert discussions on the main theme of learning from the earlier policies, plans, programmes, projects, and activities on ground for river rejuvenation and conservation, and strategizing for the future. Concerted efforts towards river cleanup in India were initiated in 1985 with the launch of Ganga Action Plan (GAP). Later, GAP was extended to river Yamuna (YAP), and then to other rivers through National River Conservation Plan (NRCP). After a thorough review of GAP, YAP and NRCP, a comprehensive Ganga River Basin Management Plan (GRBMP) was submitted by the Consortium of 7 IITs (IITC) in 2015 with an objective of restoring wholesomeness of the Ganga River. Several aspects mentioned in GRBMP served as a basis for evolving the comprehensive river rejuvenation and conservation programme referred to as "Namami Gange". At the outset of this programme it was realized that implementation of GRBMP would require expert advice, and the plan itself will have to be dynamically evolved. For this purpose, a specific body referred as Centre for Ganga River Basin Management and Studies (in short cGanga) led by IIT Kanpur – with membership of many national institutes (IITs, NITs, IISERs, IIMs, etc.) and partnering with many national and international organisations – was set up by the National Mission for Clean Ganga, the principal executive agency of the Namami Gange Programme.

The 9th IWIS has present an exhibition of past achievements of IWIS and hold intensive expert discussions on the main theme of learning from the earlier policies, plans, programmes, projects, and activities on ground for river rejuvenation and conservation, and strategizing for the future.

River rejuvenation and conservation is an interplay amongst several aspects represented in Figure 1 that include (a) setting the objective; (b) evolving river basin management plan with an appropriate framework; (c) developing, evolving and activating enablers for action on ground through science, technology, policies, laws, governance, economics, financing, and people participation; (d) ensuring that essentials 5 Ps such as political will, public spending, partnerships, participation and perseverance are in place; and most importantly (e) achieving convergence amongst another 5 Ps namely, policies, programmes, plans, projects and people's action that serve as means for activities in the field.

Several activities, tasks, projects, etc. by various central, state, local governments as well as many civil society organisations (CSOs), non-governmental organizations (NGOs), private organisations and citizens as part of many governmental and non-governmental programmes and schemes such as, Swachh Bharat Mission, Jal Jeevan Mission, Ganga Action Plan (GAP), Yamuna Action Plan (YAP), National River Conservation Plan (NRCP), Namami Gange Programme, Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Atal Bhujal Yojana, PMKY, Amrit Sarovars, Revival of Lost Rivers and Water Bodies, Cauvery Calling, Rally for Rivers, etc. have been undertaken that could be directly and/or indirectly linked to river rejuvenation and conservation. The central theme of the 9th IWIS was to assess the efficacy of river rejuvenation and conservation efforts of the past several decades as an interplay amongst several aspects schematically outlined in Figure 1 with the objective to strategize future efforts.

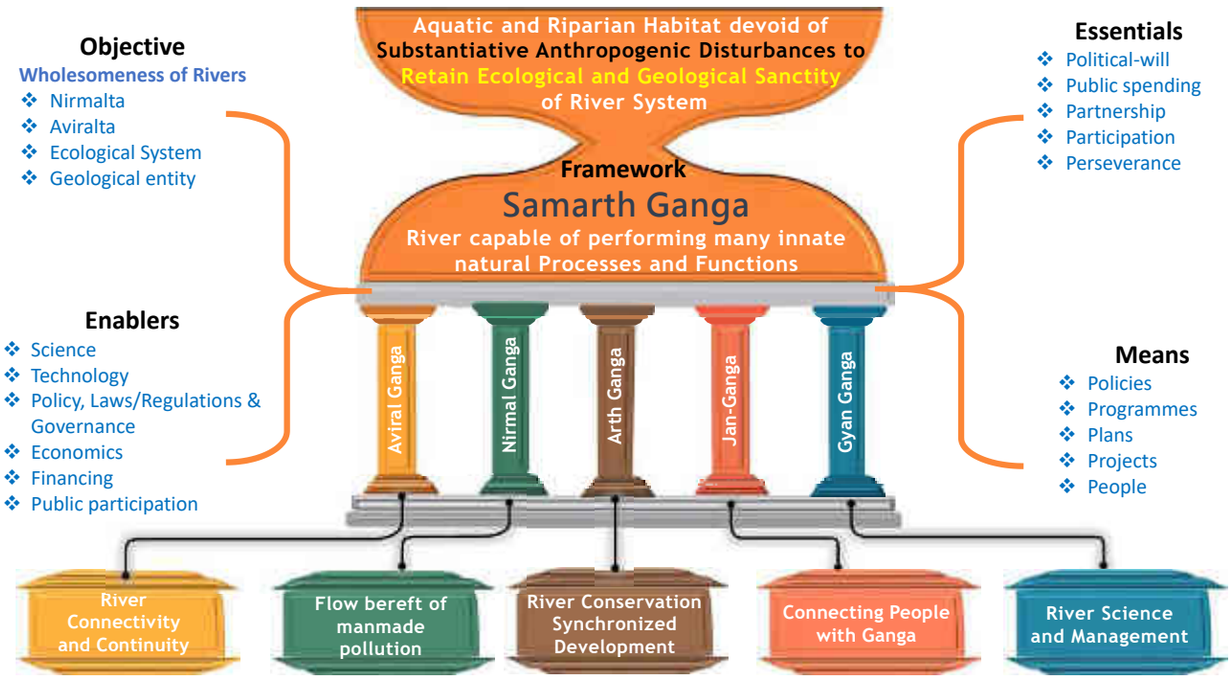


Figure 1. River Rejuvenation & Conservation: Various Dimensions

नौवीं इंडिया वॉटर इम्पैक्ट समिट एवं दूसरी क्लाइमेट इन्वेस्टमेंट एंड टेक्नोलॉजी इम्पैक्ट समिट

नदी पुनर्जीवन और संरक्षण: अतीत से शिक्षाएं और भविष्य के लिए रणनीति

इंडिया वॉटर इम्पैक्ट समिट का प्रारंभ वर्ष 2012 में आईआईटी की सात संस्थानों के संघ द्वारा गंगा रिवर बेसिन मैनेजमेंट प्लान विकसित करने के दौरान नदी बेसिन प्रबंधन के विषय में विभिन्न वैज्ञानिक, तकनीकी, सामाजिक–सांस्कृतिक, नीतिगत, कानूनी और प्रशासनिक विषयों पर स्पष्टता लाने के उद्देश्य से किया गया था। नदी बेसिन प्रबंधन के संदर्भ में देखा जाए तो असंख्य विविधताओं से भरे देश में विभिन्न हितधारकों के हित, रूझान और नदी की प्रक्रियाओं से जुड़ी समझ और दृष्टिकोण भी विविधतापूर्ण है। वर्ष 2015 में गंगा रिवर बेसिन मैनेजमेंट प्लान (जीआरबीएमपी) तैयार होने के बाद उपरोक्त विषयों पर अधिक स्पष्टता लाने के लिए छह वर्षों में प्रतिवर्ष शिखर सम्मेलन आयोजित किये गए। जिनका उद्देश्य था, नदी बेसिन प्रबंधन से संबंधित कुछ अस्पष्ट और विवादास्पद विषयों पर आपसी विमर्श और विश्लेषण के द्वारा वैज्ञानिक समझ और सर्वसम्मति विकसित करना। इसके साथ ही इन सम्मेलनों में बेसिन प्रबंधन के विश्लेषणात्मक उपकरण, डाटा संबंधी आवश्यकताओं की पूर्ति, निगरानी तंत्र और योजनाओं के क्रियान्वयन और नीतिगत मुद्दों पर सरकारी और निजी स्तर पर जारी प्रयासों और हितधारकों के बीच बेहतर समन्वय स्थापित करने के तरीकों पर चर्चा हुई। तकनीक और नवीन आविष्कारों का उपयोग करते हुए भारत के समग्र जलीय पर्यावरण का बेहतर प्रबंधन करने पर गहन मंथन हुआ।

इंडिया वॉटर इम्पैक्ट समिट आज एक बहुप्रतीक्षित शिखर सम्मेलन है। जिसमें विषय विशेषज्ञ, शासकीय प्रतिनिधि, हितधारकों के प्रतिनिधि एक मंच पर नदी घाटी प्रबंधन और जलप्रबंधन के समक्ष खड़ी चुनौतियों और समाधान के नए विकल्पों पर विमर्श करते हैं। सम्मेलन के दौरान अलग–अलग सत्रों में वैज्ञानिक, तकनीकी और नीतिगत विषयों पर विचार–मंथन होता है, साथ ही केंद्र और राज्य सरकारों के प्रतिनिधि विभिन्न विषयों पर शासन के दृष्टिकोण को स्पष्ट करते हैं। इन सत्रों में नवीन तकनीकों की समीक्षा करने के साथ, निवेशक और तकनीकी प्रदाता के हितों को समन्वित करते हुए विभिन्न पहलूओं की पड़ताल की जाती है ताकि भारत में जलप्रबंधन के क्षेत्र में तकनीक आधारित जलप्रबंधन की सुदृढ़ संस्कृति विकसित की जा सके।
इन प्रयासों के मध्य जलवायु परिवर्तन और उसके परिणामों को देखते हुए जल और पर्यावरण क्षेत्र में नवीन तकनीकों, नए आविष्कारों को सम्मिलित करने की आवश्यकता अब अनिवार्यता बन गई है। यही कारण है कि वर्ष 2023 से शिखर सम्मेलन द्विआयामी हो गया है। सम्मेलन के दो आयाम होते हैं – द इंडिया वॉटर इम्पैक्ट समिट (IWIS) और क्लाइमेट इन्वेस्टमेंटस एंड टेक्नोलॉजी इम्पैक्ट समिट (CITIS)। शिखर सम्मेलन के दूसरे आयाम का उद्देश्य समीक्षा और परीक्षण के बाद प्रौद्योगिकी प्रदाताओं और संभावित निवेशकों को साथ जोड़ना है। इंडिया वॉटर इम्पैक्ट समिट के सहआयोजन में वैज्ञानिक समीक्षा में खरी उतरी तकनीकों के क्रियान्वयन, नई तकनीकों के लिए वित्तपोषण की विधियों और व्यवसाय के नए मॉडल्स जैसे विषयों पर समन्वित चर्चाएँ होंगी। जिससे इन तकनीकों का समावेश भविष्य में ऊर्जा, कृषि, शहरी विकास, परिवहन, अधोसंरचना विकास जैसे क्षेत्रों में किया जा सके क्योंकि यह सभी क्षेत्र पर्यावरण, जल, वायु, भूमि, नदियों और जल प्रबंधन से गहनता से अंतर्संबंधित हैं।

नौवीं इंडिया वॉटर इम्पैक्ट समिट में पिछले सत्रों की उपलब्धियों पर आधारित एक प्रदर्शनी लगाई गयी। साथ ही विगत वर्षों में नदी पुनर्जीवन और संरक्षण के लिए जमीनी स्तर पर क्रियान्वित की गई योजनाओं, परियोजनाओं, कार्यक्रमों और परियोजनाओं से प्राप्त अनुभवों पर विशेषज्ञों का विमर्श हुआ और भविष्य की रणनीति तय की गयी।

भारत में नदी को स्वच्छ बनाने के लिए सम्मिलित प्रयासों की शुरूआत वर्ष 1985 में गंगा एक्शन प्लान के साथ हो गई थी। इन्ही प्रयासों को विस्तार देते हुए यमुना एक्शन प्लान भी बनाया गया। उसके बाद ऐसे ही प्रयास अन्य नदियों के लिए भी नेशनल रिवर कन्जर्वेशन प्लान (एनआरसीपी) के तहत किये गए।

गंगा एक्शन प्लान, यमुना एक्शन प्लान और नेशनल रिवर कन्जर्वेशन प्लान की विस्तृत समीक्षा के बाद सात आईआईटी (इंडियन इंस्टीट्यूट ऑफ टेक्नोलॉजी) के संघ द्वारा वर्ष 2015 में गंगा रिवर बेसिन मैनजमेंट प्लान प्रस्तुत किया गया, जिसका मुख्य उद्देश्य गंगा नदी को गंगा की संपूर्णता के साथ सहेजना था। जीआरबीएमपी (गंगा रिवर बेसिन मैनेजमेंट प्लान) में सुझाए गए कुछ बिंदुओं ने नदी पुनर्जीवन और संरक्षण के उद्देश्य से प्रारंभ किये गए नमामि गंगे कार्यक्रम के लिए मजबूत आधार तैयार किया।

नमामि गंगे के प्रारंभ में ही यह महसूस हुआ की जीआरबीएमपी के क्रियान्वयन के लिए विशेषज्ञों के मार्गदर्शन की आवश्यकता होगी साथ ही यह भी महसूस हुआ कि इस योजना की सफलता और इसकी गति, समय-समय पर योजना के मूल्यांकन, पुनर्मूल्यांकन और

नौवीं इंडिया वॉटर इम्पैक्ट समिट

में पिछले सत्रों की उपलब्धियों पर आधारित एक प्रदर्शनी लगाई गयी। साथ ही विगत वर्षों में नदी पुनर्जीवन और संरक्षण के लिए जमीनी स्तर पर क्रियान्वित की गई योजनाओं, परियोजनाओं, कार्यक्रमों और परियोजनाओं से प्राप्त अनुभवों पर विशेषज्ञों का विमर्श हुआ और भविष्य की रणनीति तय की गयी।

पुनर्विकास पर निर्भर करेगी। इसी उद्देश्य की पूर्ति के लिए आईआईटी कानपुर के नेतृत्व में सेंटर फॉर गंगा रिवर बेसिन मैनेजमेंट एंड स्टडीज जिसे सी-गंगा के नाम से जाना जाता है, की स्थापना हुई। कई राष्ट्रीय महत्व के शैक्षणिक संस्थान जैसे आईआईटी, एनआईटी, आईआईएसईआर सी-गंगा के सदस्य संस्थान हैं, साथ ही सी-गंगा की विभिन्न परियोजनाओं में भागीदार भी हैं। नेशनल मिशन फॉर क्लीन गंगा के सहयोग से सी-गंगा ना केवल राष्ट्रीय बल्कि अंतर्राष्ट्रीय संस्थानों के साथ भी साझेदारी में विभिन्न परियोजनाओं में सक्रिय है। गौरतलब है कि एनएमसीजी (नेशनल मिशन फॉर क्लीन गंगा अथवा स्वच्छ गंगा मिशन), नमामि गंगे कार्यक्रम की प्रमुख कार्यकारी संस्था है।

नदी पुनर्जीवन और संरक्षण के विभिन्न पहलू परस्पर अंतर्संबंधित हैं, जिन्हे चित्र क्रमांक 1. में दिखाया गया है। जिसमें शामिल हैं – 1. उद्देश्य का निर्धारण, 2. रिवर बेसिन मैनेजमेंट प्लान और उसका ढांचा, 3. जमीनी स्तर पर कार्यवाही के लिए विज्ञान, तकनीक, नीति, कानून, प्रशासन, वित्त पोषण और जनभागीदारी के आयामों का उचित नियोजनए 4. क्रियान्वन के लिए अनिवार्य सहयोग जैसे राजनीतिक इच्छाशक्ति, सार्वजनिक व्यय, साझेदारी, भागीदारी, और कार्यपूर्ण करने की दृढ़ता, तथा 5. विभिन्न नीतियों, योजनाओं, कार्यक्रमों और लोगों के मध्य समावेशीकरण।

केंद्र और राज्य सरकारों, स्थानीय प्रशासन, स्वयंसेवी संस्थानों और नागरिक संगठनों द्वारा संचालित कई कार्यक्रम और गतिविधियां (जैसे स्वच्छ भारत मिशन, जल जीवन मिशन, गंगा एक्शन प्लान, यमुना एक्शन प्लान, नेशनल रिवर कन्जर्वेशन प्लान, नमामी गंगे कार्यक्रम, महात्मा गांधी ग्रामीण रोजगार गारंटी कानून, अटल भूजल योजना, अमृत सरोवर, कावेरी कॉलिंग, रैली फॉर रिवर, इत्यादि) हैं, जो नदी पुनर्जीवन से प्रत्यक्ष या अप्रत्यक्ष रूप से संबंधित हैं। नौवीं इंडिया वॉटर इम्पैक्ट समिट का केंद्रीय विषय अतीत से सीखने के उद्देश्य हेतु ऊपर उल्लेखित विभिन्न पहलुओं के अंतर्गत बीते दशकों में नदी पुनर्जीवन और संरक्षण के प्रयासों की प्रभावकारिता का आंकलन करना और भविष्य के लिए रणनीति तैयार करना था।

चित्र 1: नदी पुनरुद्धार और संरक्षण: विभिन्न आयाम

PLENARY SESSION

December 04-06, 2024

Inaugural Session of IWIS 2024

The inaugural session of the India Water Impact Summit (IWIS) 2024, coupled with the Climate Investment and Technology Impact Summit (CITIS), commenced with addresses from key dignitaries emphasizing the intertwined nature of water resource management and climate action. The event underscored the theme of "River Rejuvenation and Conservation: Learning from the Past and Strategizing for the Future," aiming to assess past efforts and chart a course for impactful future initiatives.

Day 1:
Wednesday; December 4, 2024
1130 – 1300 hrs

Chair: Mr. Rajeev Kumar Mital
(Director General, National Mission for Clean Ganga)

Chief Guest: Hon'ble Minister, C R Patil
(Minister of Jal Shakti, Government of India)

Guest of Honour: Dr. Igor Papič
(Hon'ble Minister, Higher Education, Science and Innovation, Republic of Slovenia)

Moderator: Dr. Vinod Tare
(Former Professor, Founder & Advisor, cGanga, IIT Kanpur)

Vote of Thanks: Mr. Sanmit Ahuja
(Expert Member, cGanga, IIT Kanpur)

KEY SPEAKERS AND THEIR ADDRESSES

➲ **DG, NMCG (Director General, National Mission for Clean Ganga):**

- Humbly welcomed the Chief Guest, Hon'ble Minister of Jal Shakti, C R Patil ji, and the Guest of Honour, His Excellency Igor Pepič, Hon'ble Minister of Higher Education, Science and Innovation, Republic of Slovenia.
- Acknowledged the presence of representatives from Union and State governments, international partners, industry leaders, scientists, researchers, and civil society organizations, highlighting their collective commitment.
- Emphasized the coupling of IWIS with CITIS, reflecting the interconnectedness of water and climate issues.
- Recounted the evolution of IWIS since 2012 from its beginnings with the Ganga River Basin Management Plan (GRBMP), a landmark document developed by a consortium of Seven IITs.
- Stressed IWIS's role in facilitating discussions on scientific, socio-cultural, legal, and policy aspects of rivers, contributing significantly to initiatives like the Namami Gange program and the National River Conservation Program.
- Highlighted the dual challenge of mitigating climate change impacts and ensuring sustainable water management.
- Positioned CITIS as a platform to bridge the gap between technology providers and investors, fostering collaborations

Outlined the conference's focus on various aspects, including science and technology, governance, public participation, and financing, with special sessions on the peculiarities of Indian rivers (E-flows, nature-based solutions, real-time monitoring).

for impactful climate action by making solutions affordable and accessible, particularly for the global South.

- Reiterated the central theme of IWIS 2024: learning from past river rejuvenation and conservation efforts to strategize for the future.
- Outlined the conference's focus on various aspects, including science and technology, governance, public participation, and financing, with special sessions on the peculiarities of Indian rivers (E-flows, nature-based solutions, real-time monitoring).
- Urged active engagement, sharing of insights, and collaboration among participants towards actionable outcomes for a sustainable and resilient future for rivers and the climate.
- Reaffirmed commitment to the cause of rivers, river nation, and climate resilience, emphasizing the need for collective action to ensure rivers remain lifelines for future generations.
- Expressed gratitude to the Organizing Committee for their efforts in organizing the 9th IWIS.

PLENARY SESSION

December 04-06, 2024

Inaugural Session of IWIS 2024

➲ **Dr. Vinod Tare (Former Professor, Founder & Advisor, cGanga, IIT Kanpur):**

- Welcomed the dignitaries and participants.
- Recounted the genesis of the India Water Impact Summit in 2012 as a platform to gather feedback and consult experts for the Ganga River Basin Management Plan, spearheaded by a consortium of Seven IITs.
- Highlighted the evolution of IWIS into an annual flagship event since 2017, focusing solely on rivers, following the initial GRBMP in 2015 and subsequent programs like Namami Gange.
- Stressed the early realization of the importance of valuing water for river transformation, leading to the slogan "Valuing Water and Transforming Ganga."
- Expanded the understanding of "Ganga" beyond a biophysical entity to represent the soul of the nation, leading to the inclusion of nearly all rivers in the country in the summit's scope since 2017.
- Emphasized the cyclical nature of river basin management plans, requiring review every 10 years, positioning the current time as crucial for preparing the second version of the GRBMP by 2025, learning from the past decade's experiences.
- Underscored the unique position of India's rivers as "natural laboratories," offering invaluable lessons in river management applicable globally.
- Mentioned the 2019 announcement by the then President to extend the river basin management plan approach to six other rivers (Mahanadi, Narmada, Godavari,

1. Stressed the early realization of the importance of valuing water for river transformation, leading to the slogan "Valuing Water and Transforming Ganga."
2. Expanded the understanding of "Ganga" beyond a biophysical entity to represent the soul of the nation, leading to the inclusion of nearly all rivers in the country in the summit's scope since 2017.
3. Underscored the unique position of India's rivers as "natural laboratories," offering invaluable lessons in river management applicable globally.
4. Outlined the summit's agenda to review the utilization of various enablers and identify ways for improvement, focusing on learning from the past to strategize for the future.

Kaveri, Krishna, and Periyar) following the cGanga experiment.

- Expressed pleasure in the expanded participation, with 12 institutions now involved alongside IIT Kanpur, broadening the pool of knowledge and expertise.
- Acknowledged the development of a comprehensive and inclusive framework and objectives over the past decade.
- Identified the current challenge as implementation and the need to gather resources and address essential enablers.
- Highlighted the government's strong emphasis on the importance of water for economic development, advocating for a water-centric and river-centric economy.
- Outlined the summit's agenda to review the utilization of various enablers and identify ways for improvement, focusing on learning from the past to strategize for the future.
- Announced four parallel tracks during the summit, including discussions on the GRBMP's second version, addressing current challenges like environmental flows and nature-based technologies, river monitoring strategies (real-time and public participation), and issues related to water scarcity and excess.
- Mentioned the integration of financial aspects and the focus on climate investment and new technologies through CITIS, including an Environmental Technology Verification Program to adapt international technologies to Indian conditions.
- Expressed hope for fruitful discussions and inputs to shape future strategies.

PLENARY SESSION

December 04-06, 2024

Inaugural Session of IWIS 2024

➲ **Dr. Igor Papič (Hon'ble Minister, Higher Education, Science and Innovation, Republic of Slovenia):**

- Expressed his honour and pleasure to attend IWIS again, highlighting the fruitful collaboration established between experts from India and Slovenia in recent years.
- Affirmed the global recognition of clean water as a key resource of the 21st century, crucial for stability and prosperity.
- Mentioned Slovenia's active promotion of water management technologies as a non-permanent member of the UN Security Council and its involvement in international initiatives like the Alpine Convention, Barcelona Convention, Water Convention, and Danube River Basin Protection Convention.
- Highlighted Slovenia's substantial and increasing investment in science, technology, and innovation, with significant budget allocations for research in the coming years.
- Announced Slovenia's plan to invest in and create a special data centre with a high-performance computing system, which can be combined with small satellites for data processing, including AI applications.
- Expressed enthusiasm for further increasing collaboration with India, extending activities beyond the Ganga to other rivers in India and potentially other continents.
- Wished the event a very successful conference and good exchange of opinions, looking forward to the conclusions as guidelines for future activities.

Hon'ble Minister reiterated the Prime Minister's call for "Jal Sanchay" (water conservation) as a people's movement and the encouraging response from communities and recalled Atal Bihari Vajpayee's vision for river linking and expressed confidence that under Prime Minister Modi, significant progress in this area will be made within the next year.

➲ **Hon'ble Minister C R Patil (Minister of Jal Shakti, Government of India):**

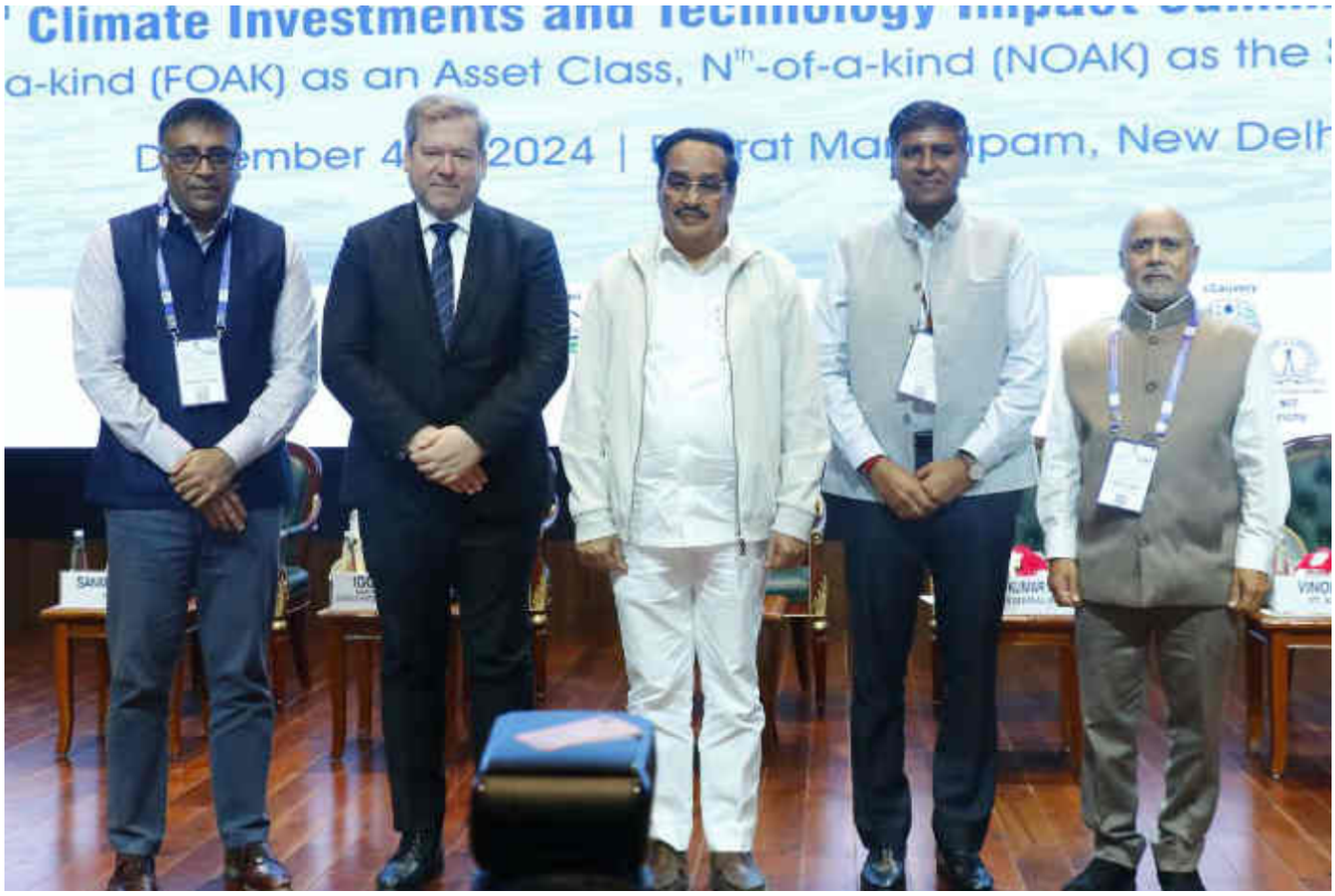
- Greeted the dignitaries and participants, acknowledging their expertise in water issues.
- Echoed Dr. Tare's sentiment about the Ganga being the soul of India.
- Emphasized the collective work of various individuals and institutions towards national development, including the crucial role of those working on water resources.
- Highlighted the commitment and successful outcomes achieved under the leadership of Prime Minister Narendra Modi in the water sector, citing the completion of the Sardar Sarovar Dam and its benefits to water-scarce regions in Gujarat, Rajasthan, and Maharashtra.
- Underlined the cultural significance of rivers in India, revered as mothers, and their vital role in water supply, agriculture, and industry.
- Acknowledged the technical expertise and experience contributing to river rejuvenation efforts.
- Mentioned the ambitious goal of making 150 dark zone districts water-secure within a short timeframe through river and rainwater harvesting initiatives.

PLENARY SESSION

December 04-06, 2024

Inaugural Session of IWIS 2024

- Reiterated the Prime Minister's call for "Jal Sanchay" (water conservation) as a people's movement and the encouraging response from communities.
- Recalled Atal Bihari Vajpayee's vision for river linking and expressed confidence that under Prime Minister Modi, significant progress in this area will be made within the next year.
- Stressed the importance of knowledge sharing through summits like IWIS for informing authorities and shaping effective strategies.
- Mentioned the focus on six key issues during the summit, anticipating their contribution to water security in the country.
- Highlighted the government's plan to transfer excess water from flood-prone areas to water-scarce regions.
- Detailed efforts to prevent polluted water from entering the Ganga and its tributaries by setting deadlines for DPRs (Detailed Project Reports) for sewage treatment and mandating the use of tertiary treated water by industries along the Ganga.
- Acknowledged that the Ministry's efforts are not exhaustive and emphasized the need for collaboration and knowledge sharing to achieve greater progress.
- Reiterated the potential for India to become water-secure under Prime Minister Modi's leadership through water conservation and management.
- Concluded with a call for continued cooperation and the slogan "Bharat Mata Ki Jai" (Victory to Mother India).



PLENARY SESSION

December 04-06, 2024

Inaugural Session of IWIS 2024

FORMAL VOTE OF THANKS:

- Mr. Sanmit Ahuja delivered the formal vote of thanks at the inaugural session of the India Water Impact Summit (IWIS) 2024, following the addresses of the Hon'ble Minister Patil Ji and Dr. Igor Papič. His address served to summarize the key achievements and future directions highlighted during the opening and extended gratitude to the various stakeholders involved.
- **Acknowledgement of Dignitaries:** He began by acknowledging the esteemed guests on stage: Hon'ble Minister Patil Ji, Dr. Igor Papič (Minister of Science, Higher Education & Innovation, Republic of Slovenia), Sri Rajiv Mital Ji (DG, NMCG), and Dr. Vinod Tare (Founder, cGanga, IIT Kanpur). He extended these acknowledgements to Their Excellencies, ladies and gentlemen, friends, and colleagues from India and around the world, echoing the sentiments previously expressed by Dr. Tare.
- **Reassurance to the Hon'ble Minister:** Mr. Ahuja assured the Hon'ble Minister and all attendees that the summit, comprising a unique intersection of science, policy implementation, engineering, technology, economics, finance, legal, and governance, represented a significant step towards collaborative action. He emphasized the rarity of these diverse disciplines coming together under one roof to interact, appreciate, and understand each other's roles in river conservation, rejuvenation, and climate protection.

Mr. Ahuja assured the Hon'ble Minister and all attendees that the summit, comprising a unique intersection of science, policy implementation, engineering, technology, economics, finance, legal, and governance, represented a significant step towards collaborative action.

- **Gratitude to Key Organizations:** He expressed sincere thanks to the key organizations instrumental in the implementation of the summit: NMCG, Ministry of Jal Shakti, NRCD, cGanga, and Niti Aayog.
- **Call to Action for Continued Engagement:** Mr. Ahuja urged participants to actively engage in the planned activities over the next two days, including today and the subsequent days.
- **Highlighting the Technology Exhibition:** He drew attention to the "very interesting exhibition" showcasing numerous technologies from India and around the world, noting that technology innovators would present their solutions to the esteemed panellists.

ANNOUNCEMENTS AND KEY HIGHLIGHTS:

- **Strengthened Partnership with Slovenia:** He announced the deepening partnership with Slovenia, signifying its progression to the next level, and thanked Dr. Papič and Slovenian colleagues.
- **Coalition of River Basin Innovation and Management:** A significant announcement was the formation of a coalition focused on River Basin Innovation and Management. The aim of this coalition is to resolve river-related issues and facilitate rejuvenation by enhancing the understanding of riverine processes through scientific, technical, and data collection efforts, involving institutions joining cGanga under the NRCD's CAMP program.

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- **Universal Knowledge Sharing (CoRBM Initiative):** Mr. Ahuja emphasized that the knowledge generated should not be limited to India but shared universally through the "CoRBM" initiative.
- **Knowledge to Action Hub for Sewage Sludge Management:** With the increasing implementation of wastewater treatment programs and the consequent rise in sewage sludge generation, he announced the launch of a "Knowledge to action Hub." This hub aims to translate the collective global knowledge on sewage sludge management into practical implementation strategies.
- **ETV (Environmental Technology Verification) Program:** He highlighted the success of the ETV program, with over 60 technologies now part of it, and acknowledged the participation of successful technology implementers. He also thanked Norway and Slovenia for their strong partnership in this endeavour, along with other countries showcasing their innovations.
- **Partnership with National Law University of Meghalaya:** Mr. Ahuja expressed gratitude to the National Law University of Meghalaya for partnering in launching a unique program on climate governance, economics, and finance, aligning with the summit's theme of transforming Ganga and valuing water and nature.
- **Plenary Sessions:** He announced two plenary sessions following lunch: one on understanding Indian River systems

and another on the inaugural of the CITIS program, focusing on "First of a kind" (FOAK) systems and their importance.

- **Round Table on Green Hydrogen with Slovenia:** A parallel round table discussion on low carbon or green hydrogen with the Slovenian delegation was announced for 2:00 PM in Room 15, highlighting the crucial linkage between water and green hydrogen production.
- **Acknowledgement of Partners and Sponsors:** Mr. Ahuja expressed gratitude to all the partners and sponsors whose hard work and support made the event possible, acknowledging the travel of many participants from various parts of India and the world.

PLENARY SESSION ON CAMP PROJECT

December 04-06, 2024

Indian Rivers: Similarities and Peculiarities

This session focused on the Condition Assessment and Management Plan (CAMP) Project initiated by the National River Conservation Directorate (NRCD), Department of Water Resources, River Development & Ganga Rejuvenation (Do WR, RD & GR), Ministry of Jal Shakti, Government of India for six river basins (Narmada, Mahanadi, Godavari, Kaveri, Krishna, and Periyar), drawing lessons from the Ganga River Basin Management Plan (GRBMP). The discussion aimed to highlight the similarities and unique characteristics of these rivers, the progress made under CAMP, challenges faced, and expectations from stakeholders.

Day 1:
Wednesday; December 4, 2024
1400 – 1530 hrs

Chair: Shri Pradeep Agrawal
(Joint Secretary, NRCD, Do WR, RD & GR, Ministry of Jal Shakti, Government of India)

Moderator: Dr. Vinod Tare
(Former Professor, Founder & Advisor, cGanga, IIT Kanpur)

Key Speakers:
Dr. R Biniwale (NEERI, Nagpur)
Dr. N V Umamahesh (NIT Warangal)
Dr. Ishtiaq Ahmad (NIT Raipur)
Dr. Pranab Mohapatra (Gandhinagar)
Dr. Manjula (NIT Tiruchirappalli)
Dr. Athira P (IIT Palakkad)
Dr. Tomaž Rodič (SPACE-SI)

PRESENTATIONS FROM EACH PARTICIPANT:

➲ **Dr. Vinod Tare (cGanga, IIT Kanpur):**

- Provided an overview of the CAMP project, initiated following the President's announcement in 2019, mirroring the efforts for the Ganga.
- Emphasized that Ganga serves as a symbol for all Indian rivers, necessitating a nationwide concern for river health.
- Introduced "cNarmada," "cMahanadi," "cGodavari," "cKrishna," "cCauvery," and "cPeriyar" as centres established in 12 institutions, modelled after cGanga, for focused studies on these river basins.
- Reported that the project commenced at the beginning of the current financial year and has completed three quarters of its three-year timeline.
- **Highlighted the first deliverable**: "River at a Glance" reports for Mahanadi, Narmada, Godaveri, Krishna, Cauvery, and Periyar, outlining salient basin features.
- **Mentioned the second deliverable:** Basin demography reports from all six river basins.
- **Discussed the third deliverable:** Reports on available aerial drone surveys in each

Dr. Vinod Tare provided an overview of the CAMP project, initiated following the President's announcement in 2019, mirroring the efforts for the Ganga and briefly updated on other planned deliverables for subsequent quarters, emphasizing that tasks often span multiple years.

basin, identifying gaps for future strategizing.

- Briefly updated on other planned deliverables for subsequent quarters, emphasizing that tasks often span multiple years.
- Requested presenters to focus on the unique peculiarities and specific challenges of their assigned river basins rather than general features.
- Invited Shri Pradeep Agrawal ji to share his expectations on behalf of the Government of India and stakeholders.

PLENARY SESSION ON CAMP PROJECT

December 04-06, 2024

Indian Rivers: Similarities and Peculiarities

➲ **Shri Pradeep Agrawal, (Joint Secretary, NRCD, Do WR, RD & GR, Ministry of Jal Shakti Government of India):**

- Welcomed participants to the session on the similarities and peculiarities of Indian rivers.
- Underscored the paramount importance of rivers and water for human life and the global concern for their deteriorating state.
- Acknowledged the commonality of the need to address river flow, water quality, and groundwater across all rivers.
- Reflected on past efforts since 1985, noting significant infrastructure development but a failure to achieve desired outcomes, with many rivers remaining polluted.
- Stressed the necessity of changing the approach to river and pollution management.
- Highlighted the Ganga River Basin Management Plan (conceived in 2010 with IIT consortium) and the visible improvements in the Ganga's main stem, while acknowledging the need for focus on tributaries.

- Expressed satisfaction with the establishment of six centres for the CAMP project and their quarter-wise deliverables, aimed at developing mission-mode action plans (Aviral Dhara, Nirmal Dhara, Ecological Restoration, Sustainable Agriculture, etc.).
- Emphasized the implementable nature of these plans, with states as crucial stakeholders actively participating and sharing existing data to avoid duplication.
- Shared shocking findings from a WII ecological assessment of seven rivers, revealing significant deterioration of ecological health and the impact on flora, fauna, and biodiversity.
- Urged the institutes to provide actionable and implementable plans for climate change mitigation and resilience, referencing thorough visits conducted to understand their methodologies.
- Expressed hope for comprehensive studies and future action plans.

PLENARY SESSION ON CAMP PROJECT

December 04-06, 2024

Indian Rivers: Similarities and Peculiarities

➲ **Dr. Ishtiaq Ahmad (Mahanadi River Basin - NIT Raipur & NIT Rourkela)**

- Presented an overview of the Mahanadi River Basin (originating from Sihava Hill, flowing 900 km to the Bay of Bengal), highlighting Chilka Lake and Hirakud Dam as key features.
- Identified disturbed (polluted industrial and agricultural pesticide use areas, mining-affected regions like Dipka coal mine) and vulnerable areas.
- Reported a significant population growth hike in Kabir Dham, Chhattisgarh (40% in 2001-2011), due to returning workers.
- Discussed aerial drone surveys, noting restricted zones and proposed survey areas focusing on flood-prone and urban flooding regions in Chhattisgarh (7,782 sq km) and Odisha (113,115 sq km).
- Raised concerns about the lack of records for notified/non-notified slums and demographic reports post-2011 census, as well as the inability to share aerial/drone survey data due to agency policies.
- Highlighted the critical water quality situation in Supebeda village, Gariaband district, Chhattisgarh, with 130 casualties in 15 years due to poor groundwater, leading to advice to use comparatively cleaner river water.

- **Dr. Pranab Mohapatra (Narmada River Basin - IIT Gandhinagar & IIT Indore):**
- **Outlined challenges in the Narmada Basin:** Water pollution, deforestation, water extraction, sedimentation (affected by large dams), and climate change.
- **Peculiarity:** Many large dams capturing sediment, impacting downstream sediment flow. Planning to estimate sediment deposition patterns.
- Highlighted sand mining and socio-economic challenges post-Sardar Sarovar Dam, emphasizing the crucial role of stakeholder involvement (two sessions conducted with SSNL, NCA, and state agencies).
- Stressed the importance of collaboration with government agencies (WRD, Irrigation, SPCB), local communities, NGOs, and researchers.
- Noted the extensive existing research on the Narmada Basin.
- Emphasized the need for private sector involvement and policy coordination across four states.
- **Peculiarity:** Well-defined banks unlike most Himalayan rivers. High community participation in upper and lower parts (forest people, Adivasis), less in the industrialized middle part.
- Reported aerial surveys conducted for the lower Narmada Basin.

PLENARY SESSION ON CAMP PROJECT

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Indian Rivers: Similarities and Peculiarities

- **Dr. R Biniwale (Godavari River Basin - NERI Nagpur & IIT Hyderabad):**
- Reported traveling the entire length of the vast Godavari River (3.5 million sq km basin area, 19 tributaries).
- **Peculiarity:** Cultural significance, referred to as "Ganga" in Nasik. Originates from Brahmagiri with religious and functional structures along its course (flood-level indicators).
- **Major challenge:** Kumbh Mela (every 12 years) causing significant pollution.
- Other challenges: Topographical changes, soil erosion, flow pattern changes, pollution from brick kilns, foam formation due to outdated STPs.
- Noted 29 dams, with Jayakwadi Dam often not reaching full capacity amidst water scarcity in Marathwada (competing water use for irrigation, drinking, industry).
- **Concerns:** Population growth, industrialization pressures, waste management, sewage treatment, solid waste dumping near rivers.
- Developed a water quality index highlighting data gaps. Major challenge: lack of continuous data.
- Proposed two approaches: empower local communities for pollution mitigation with expert support, and use advanced tools (satellite imaging, AI) for comprehensive data collection to address gaps and reconcile outdated data.

➲ **Dr. N V Umamahesh (Krishna River Basin - NIT Warangal & NITK Surathkal):**

- Described the Krishna Basin as one of the largest in the Peninsular system, spanning Maharashtra, Karnataka, Telangana, and Andhra Pradesh with significant industrialization and urbanization.
- Cultural and agricultural importance but heavily exploited with numerous dams for hydropower and irrigation, leading to altered flow patterns and reduced ecological flows (especially in the Krishna Delta).
- **Major concern:** Pollution from cities (Pune, Kolhapur, Solapur, Hyderabad, Vijayawada, Kurnool) and the Musi River (Hyderabad) as a hotspot.
- **Other challenges:** Deforestation, soil erosion, land degradation, high population density in pockets (Maharashtra).
- **Key challenge:** Maintaining Environmental Flows disrupted by dams. Unsustainable agricultural water consumption (80% land irrigated).
- **Other issues:** Sand mining, land regulation, embankment erosion.
- **Challenge:** Inter-state coordination among four states. Planning stakeholder meeting for collaborative problem-solving.
- **Aim:** Develop strategies for wastewater treatment, sewage infrastructure improvement, integrated agricultural practices, and contribute to Telangana's regional municipal strategies.
- Focus on managing numerous projects and inter-state water resource coordination. Planning thorough fieldwork like the Godavari team.
- **Challenge:** Data collection on projects and dam operations.

PLENARY SESSION ON CAMP PROJECT

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Indian Rivers: Similarities and Peculiarities

➲ **Dr. Manjula (Cauvery River Basin - IISc Bangalore & NIT Trichy):**

- Highlighted the significant ecological, environmental, cultural, historical, and social importance of the Cauvery Basin, spanning Tamil Nadu, Karnataka, Kerala, and Puducherry, serving around 64 million people.
- Observed varying levels of disturbance across the basin, with urban areas like Bengaluru and coastal regions near Nagapattinam and Thiruvarur being more impacted.
- **Identified key challenges:** Water scarcity (interstate disputes), pollution (industrial areas like Tirupur and Coimbatore), over-extraction, flow regulation for agriculture, climate change impacts, sedimentation, erosion, and biodiversity loss.
- **Detailed data-related requirements and challenges:** Need for expensive high-resolution satellite data, availability of topographical sheets in varied formats, temporal gaps in existing satellite imagery, difficulties in obtaining accurate hydrological and hydraulic data from the CWC, gaps in groundwater data, and challenges in acquiring slum data from state authorities.
- Announced plans to organize a stakeholder meeting to address data gaps and facilitate data augmentation for the Cauvery Basin study.

Dr. Manjula highlighted the data-related requirements and challenges i.e., need for expensive highresolution satellite data, availability of topographical sheets in varied formats, temporal gaps in existing satellite imagery, difficulties in obtaining accurate hydrological and hydraulic data from the CWC, gaps in groundwater data, and challenges in acquiring slum data from state authorities.

➲ **Dr. Athira (Periyar River Basin - IIT Palakkad & NIT Calicut):**

- Introduced the Periyar River Basin as the smallest among the six, covering around 5000 sq km in Kerala, with significant socio-economic and cultural importance as the state's largest river system.
- Characterized the basin by its stark topographic difference (sea level to over 2000 m), facilitating hydropower projects (~800 MW) and supporting ecosystem-rich upstream areas with wildlife sanctuaries and tourism.
- Identified key challenges: persistent flooding in the highly populated Cochin area, exacerbated by tidal and fluvial effects, high population density in Cochin, natural disasters (landslides, especially in Idukki), and pollution from quarrying and industrial zones downstream.
- Noted demographic trends: high population density in Ernakulam and Thrissur, lower in Idukki with rural-to-urban migration. The basin's districts contribute significantly to Kerala's agriculture.
- Reported challenges in the CAMP project: difficulty in determining the proper basin boundary due to the lack of high-resolution Digital Elevation Models (DEMs), and challenges in conducting drone surveys in restricted upstream areas.
- Outlined primary deliverables: a River Basin Management Plan focusing on flood management in the downstream, a flood monitoring and forecasting system, and measures to improve water quality and river health through stakeholder collaboration. Highlighted a significant gap in the limited number of river gauge stations (only two) and plans to establish a denser network.

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Indian Rivers: Similarities and Peculiarities

➲ **Dr. Tomaž Rodič (Space SI, Slovenia):**

- Introduced Space SI as a centre of excellence for space sciences and technologies in Slovenia, working on low-cost microsatellite systems for river basin monitoring.
- Highlighted the system's components: agile spacecraft capable of following river paths, a ground station, and data processing facilities.
- Emphasized the satellite's capability to cover 1000 km in 3 minutes and provide immediate data, overcoming the limitation of cloud cover that hinders traditional satellite data acquisition, especially during monsoons.
- Showed an image of a Slovenian transboundary river illustrating typical data obtained: river discharge, sediment flow, and interaction with agriculture, urban environments, and tourism.
- Explained the use of multispectral imagery to gather multi-sectoral information related to water, food production, energy, and ecosystem properties.
- Showcased a video demonstrating the agile satellite's ability to follow river paths from source to sea and perform cross-section analysis (e.g., Sava River).
- Detailed the use of this data for mapping soil moisture, vegetation states, and modelling rainfall and water propagation.
- Mentioned a collaborative project in Kenya focusing on flood-prone villages and disaster scenario modelling, similar to flood events in Slovenia.
- Expressed excitement about the technology's potential for river basin management and its socio-economic and environmental impacts, noting growing interest from industries in flood-prone areas for ecological solutions and collaboration.

STAKEHOLDER REFLECTIONS:

➲ **Er. Ashutosh Das (Odisha Stakeholder - Mahanadi River Basin):**

- Highlighted the vast size difference between basins like the Godavari and the smaller Periyar, yet emphasized the uniqueness of each.
- Used the Periyar as an example of the development-conservation balance in hydroelectric power generation.
- Drew a parallel between the flow of water (symbolically shown earlier) and the continuous, dynamic flow of rivers shaping lives and resonating with "pranic" energy.
- Emphasized the emotional connection to rivers as sustaining sources and integral parts of identity, connecting communities longitudinally, transversely, and over time.
- Focused on the personal connection to the Mahanadi River as a life source.

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Indian Rivers: Similarities and Peculiarities

DISCUSSION ON PUBLIC PARTICIPATION:

➲ **Dr. Vinod Tare: (cGanga, IIT Kanpur)**

- Expressed concern about how to sensitize people and enhance public participation beyond rallies and conferences.
- Emphasized the need to empower citizens to act as custodians and monitors of rivers and to help in implementing government and other programs.
- Reiterated the focus of a specific session on public participation, aiming to move beyond symbolic gestures and involve citizens in understanding and overseeing treatment plants and river management.
- Stated the ambition for every citizen to know the status and functionality of treatment plants in their area as a form of active public participation.
- Believed that providing information and data to the public will foster a deeper sense of responsibility beyond mere reverence for rivers.

➲ **Dr. Hari Om Sharma (Jeevan Dhara Namami Gange Foundation):**

- Introduced the foundation's work across 25 Ganga basin regions and 5 states, focusing on translating research into practical implementation, drawing inspiration from the 1925 Chicago University post-behavioural revolution.
- Proposed adopting the "Arth Ganga Mission" in 26 Ganga basin districts, specifically targeting rural farming communities, labourers, and workers to improve their economic conditions and livelihoods, fostering sustainable development.
- Advocated for the integration and empowerment of the Arth Ganga Mission within the NMCG framework, extending this model to other river basins like Narmada, Godavari, and Cauvery, recognizing their natural and cultural heritage.
- Suggested forming dedicated teams to work practically within the villages of these river basins, emphasizing a collective

responsibility approach for unified and impactful field-level implementation, inspired by past successful initiatives.

➲ **Dr. Hemanth Yadav (Participant):**

- Observed that District Ganga Samitis primarily consist of members from NITs and IITs (including those submitting research papers) without representation from fieldwork teams or district-level committees.
- Advocated for the involvement of local committees in districts, bringing practical experiences and highlighting ground-level issues and solutions, contrasting academic data with real-world data.
- Reflected on the significant reduction in pollution during the COVID lockdown, questioning if such a positive environmental impact could be replicated globally for rivers like the Ganga by limiting pollution sources and unnecessary industrial operations.
- Shared a 35-year personal connection to the Ganga in Varanasi, his work in river protection (including an NSS award later returned due to dissatisfaction), and observations on altered drainage patterns due to construction, as well as chemical contamination.
- Reiterated the question about replicating lockdown-level environmental improvements and emphasized the need for a robust river protection system involving collaborative efforts from all relevant ministries and mandatory distances for construction near riverbanks.
- Stressed the importance of practical efforts alongside cultural and religious attachments to rivers, particularly concerning planning and plastic restriction for the upcoming Maha Kumbh.

PLENARY SESSION ON CAMP PROJECT

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Indian Rivers: Similarities and Peculiarities

➲ **Dr. Vinod Tare (Responding to Audience):**

- Acknowledged the validity of the points raised but highlighted the challenge of achieving convergence due to diverse organizational backgrounds and perspectives (central vs. state level priorities).
- Emphasized that convergence is not solely the responsibility of academic institutions and requires equitable representation and opportunities for all stakeholders within program boundaries and timelines.
- Stated the program's objective to gather public perspectives for idea exchange and collaboration on improving public participation and convergence at the local level to address specific river challenges and solutions.
- Framed this as an ongoing annual process to adapt to changing circumstances, with institutions, governments, NGOs, and private organizations gradually building frameworks for issues like plastic waste.
- Used the lockdown pollution reduction as evidence of achievable results for rivers like the Ganga through planned efforts, emphasizing the need to consolidate and implement best practices and scale up public participation for collective progress.

GIST

This session discussed the Condition Assessment and Management Plan (CAMP) for six major Indian river basins. It highlighted the government's initiative to extend the Ganga River Basin Management Plan to other rivers, involving 12 institutions. The session reviewed progress on "River at a Glance" and "Basin Demography Reports", aerial drone surveys, and future deliverables. Presenters focused on the unique challenges of each basin, including pollution, water extraction, and the need for actionable, implementable plans. The importance of stakeholder involvement, data collection, and addressing specific basin peculiarities was emphasized.

KEY TAKE AWAY POINTS

- **CAMP Project:** The Government of India's CAMP project aims to study and manage six river basins, mirroring the Ganga initiative.
- **Collaborative Effort:** 12 institutions are involved, with a focus on delivering actionable plans.
- **Quarterly Deliverables:** Draft of Reports on "River at a Glance" and “Basin Demography” are available.
- **Unique Basin Challenges:** Each river basin presents unique challenges requiring specific attention.
- **Stakeholder Involvement:** States and other stakeholders are actively participating in their studies.
- **Actionable Plans:** The goal is to develop implementable, mission-mode action plans.
- **Ecological Assessment:** A study by the Wildlife Institute of India highlighted the deteriorating ecological health of rivers.
- **Data and Technology:** Utilizing data and advanced technologies is crucial for effective river management.
- **Public Participation:** The importance of public involvement and empowerment in river conservation efforts was discussed.
- **Convergence:** Achieving convergence among various stakeholders is essential for effective river management.

PLENARY SESSION-CITIS

December 04-06, 2024

First of a Kind (FOAK) to Nth of a Kind (NOAK): Scaling Climate Technologies

This session delved into the critical challenges and strategies involved in bringing innovative climate and water technologies from the lab to widespread adoption and commercial success. The discussion highlighted the importance of addressing the "valley of death" in technology commercialization and fostering a supportive ecosystem for both innovators and investors.

Day 1:
Wednesday; December 4, 2024
1600 – 1745 hrs

Chair: Dr. Vinod Tare
(Former Professor, Founder & Advisor, cGanga, IIT Kanpur)

Moderator: Mr. Sanmit Ahuja
(Expert Member, cGanga, IIT Kanpur)

Key Speakers:
Mr. Ankit Todi
(Chief Sustainability Officer, Mahindra Group)
Mr. Shiv Shanker
(Partner, Ankur Capital)
Mr. Rajan Mehta
(Founder, Climate Action Labs)
Mrs. Swapna Gupta
(Partner, Avaana Climate and Sustainability Fund)

CORE THEMES AND DISCUSSION POINTS

- **The FOAK to NOAK Challenge:** The central problem identified is the difficulty in scaling "First of a Kind" (FOAK) technologies to "Nth of a Kind" (NOAK) widespread adoption. Many promising innovations fail to move beyond the initial demonstration phase.
- **The Nexus of Water and Climate:** The session began by explaining the interconnectedness of water and climate issues, justifying the co-location of the India Water Impact Summit (IWIS) and the Climate Investment and Technology Impact Summit (CITIS).
- **Barriers to Market Entry and Scaling:** Several pinch points hindering the commercialization of innovative technologies were discussed:
  - **Funding Gap:** Lack of investors willing to fund technologies between the lab and large-scale commercialization (the "valley of death").
  - **Scale-Up Challenges:** Difficulty in achieving the necessary scale and balance sheet for attracting significant growth capital.
  - **Education and Understanding:** Startups often lack a clear understanding of their position in the value chain and how to price their solutions for the market. Investors also

Startups often lack a clear understanding of their position in the value chain and how to price their solutions for the market. Investors also need education on the specific risks and opportunities in climate technology.

need education on the specific risks and opportunities in climate technology.

- **Risk Quantification:** Inadequate risk assessment by innovators, hindering investor confidence.
- **Procurement Challenges:** Government procurement processes can be cumbersome and not conducive to adopting novel technologies.
- **Misallocation of Capital:** Development finance institutions may not be effectively deploying capital to de-risk early-stage technologies.
- **Slow Capital Churn:** Long investment cycles in climate technology funds can deter further investment.
- **Mindset Issues:** Reluctance to adopt

PLENARY SESSION-CITIS

December 04-06, 2024

First of a Kind (FOAK) to Nth of a Kind (NOAK): Scaling Climate Technologies

technologies not proven in the local Indian context.

- **Strategies for Overcoming Barriers:** The panellists proposed several strategies:
  - **Creating a FOAK Asset Class:** Recognizing early-stage climate technology as a new investment opportunity for venture capital, government, and industry.
  - **Technology Affordability:** Driving down the cost of proven technologies through localization, manufacturing in India, and economies of scale.
  - **Building Ecosystems:** Fostering collaborations between innovators, SMEs (as system integrators), large corporates (as early adopters and scalers), and investors.
  - **Risk Mitigation:** Development finance institutions should focus on de-risking technologies through guarantees and other mechanisms.
  - **Educating Stakeholders:** Educating startups on commercialization processes and investors on climate tech opportunities.
  - **Streamlining Procurement:** Governments should create clearer pathways for adopting and funding innovative solutions.
  - **Demonstration and Pilot Projects:** Putting the "first one on the ground" is crucial for building confidence and attracting further investment.
  - **Targeting Specific Hubs:** Creating dedicated "clusters of excellence" focused on specific technology areas (e.g., tyre recycling, HDPE recycling).

- **Leveraging Existing Assets:** Efficiently utilizing existing government and institutional assets.
- **Patient Capital:** Investors need to be prepared for longer timelines and multiple challenges in scaling climate technology.
- **Corporate Climate Activism:** Large corporations need to actively drive the adoption and scaling of sustainable solutions.
- **The Role of Government and Policy:** Supportive policies, regulations, and government procurement are crucial for creating demand and enabling the scaling of climate technologies.
- **The Importance of Economic Models:** Innovative economic models, beyond just technology solutions, are needed to incentivize adoption (e.g., commodity funds for crop residue).
- **Focus on Emerging Markets:** Designing climate solutions with the price points of emerging markets in mind from the outset is essential for global impact.
- **The Example of Renewable Energy and EVs:** The success of solar and electric vehicles in India, driven by policy support and decreasing costs, provides a blueprint for other climate technologies.
- **The Potential of SMEs:** Small and medium enterprises can play a significant role in the regional deployment and scaling of climate solutions.

GIST

The session addressed the critical need to bridge the gap between innovative climate technologies (FOAK) and their widespread adoption (NOAK). The panellists identified key barriers, including funding gaps, scale-up challenges, lack of market understanding, and risk aversion. They emphasized the importance of creating a supportive ecosystem involving innovators, investors, corporates, and government, along with strategies like driving down technology costs, de-risking investments, and fostering collaboration. The discussion highlighted the need for patient capital, targeted hubs of excellence, and supportive policies to accelerate the deployment of climate solutions and achieve meaningful impact, particularly in emerging markets.

PLENARY SESSION-CITIS

December 04-06, 2024

First of a Kind (FOAK) to Nth of a Kind (NOAK): Scaling Climate Technologies

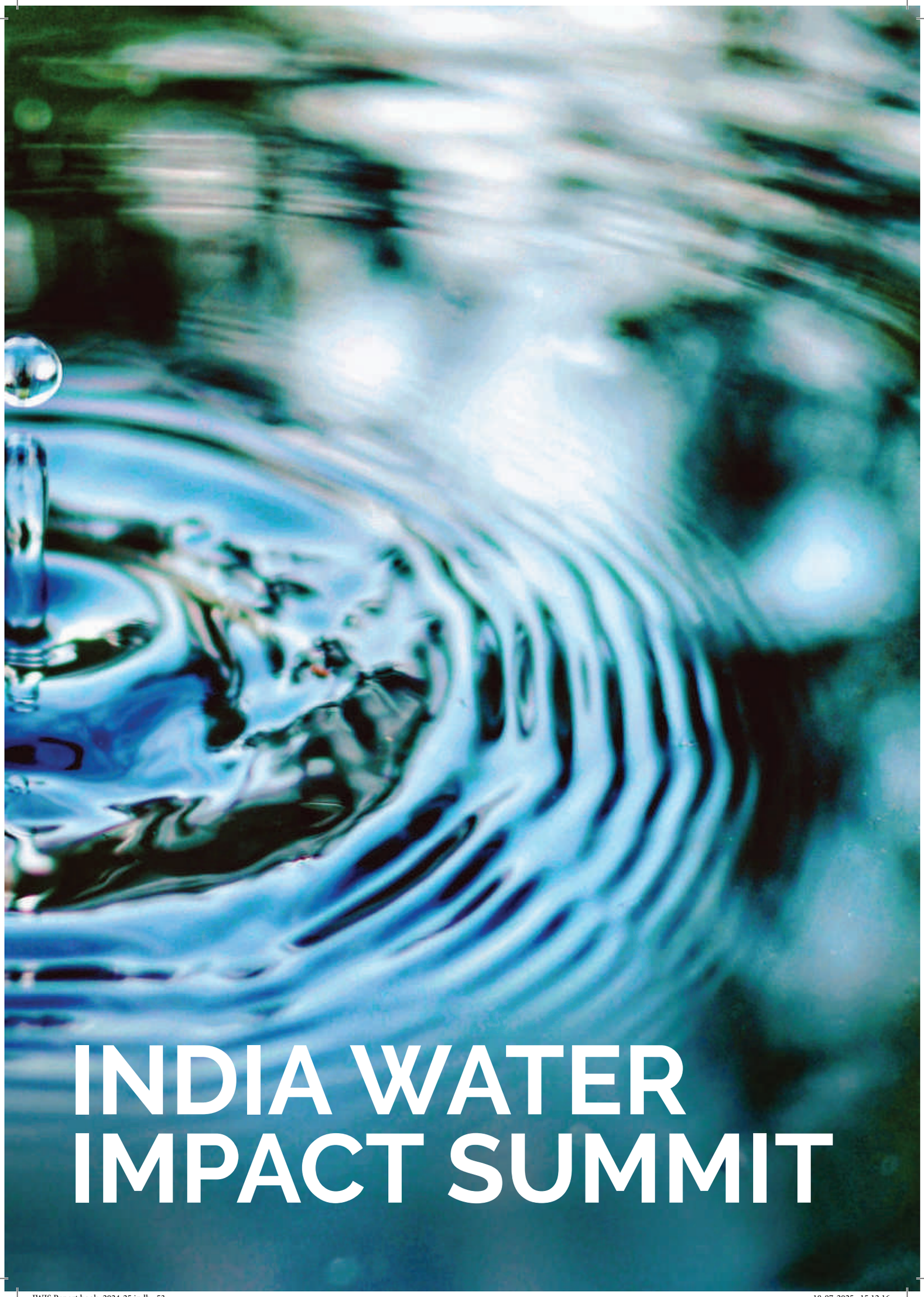







KEY TAKE AWAY POINTS

- Scaling climate technologies from FOAK to NOAK requires a concerted effort from all stakeholders.
- Addressing the "valley of death" in funding and commercialization is crucial.
- Technology affordability is a major lever for adoption, especially in emerging markets.
- Building robust ecosystems and fostering collaboration are essential for success.
- Governments play a vital role in creating supportive policies and de-risking investments.
- Understanding the specific needs and challenges of the Indian market is paramount.
- Patient capital and a long-term perspective are necessary for scaling disruptive technologies.
- Focusing on creating demand and demonstrating the viability of FOAK projects is key to attracting investment and driving adoption.
- SMEs have a significant role to play in the regional scaling of climate solutions.
- Learning from the success stories of solar and EVs can provide valuable insights.


INDIA WATER
IMPACT SUMMIT

Relevance & Robustness of the Indian Framework for River Rejuvenation and Conservation vis-à-vis Global Frameworks

Day 2:
Thursday; December 5, 2024
0930 – 1100 hrs

Chair: **Mr. G Asok Kumar**
(Retd IAS & Former DG NMCG & Honorary Senior Fellow, CPR)

Moderator: **Dr. Vinod Tare**
(Former Professor, Founder & Advisor, cGanga, IIT Kanpur)

Panelist/ Lead Discussant:
Dr. Samir Bajpai (NIT Raipur)
Dr. Pranab Kumar Mohapatra (IIT Gandhinagar)
Dr. N V Umamahesh (NIT Warangal)
Dr. Athira P (IIT Palakkad)
Dr. Santosh G Thampi (NIT Calicut)
Mr. Sachhidanand Sahasraduddhe (ESTPL, Nagpur)
Dr. Kishanjit Kumar Khatua (NIT Rourkela)
Dr. Priyank Sharma (IIT Indore)
Dr. B Sridharan (IIT Palakkad)
Dr. Uday Bhonde (NIUA, New Delhi)
Dr. Nupur Bahadur (TERI, New Delhi)
Dr. Deepak Singhania (IIT Gandhinagar)
Mr. Prabhash Kumar (SMCG, UP)
Mr. R K Jain (Uttarakhand Peyjal Nigam, Haridwar)
Dr. Ashwini Mirajkar (NIT Nagpur)
Dr. Suresh Kumar Thappeta (NIT Nagpur)
Mr. Amit Kumar (SMCG, Jharkhand)

Rapid industrialization and urbanization in the last few centuries have affected ecosystems all over the world including many rivers that degraded significantly due to rapidly expanding human needs and waste generation. This in turn has affected human wellbeing and developmental futures. To stem this downslide, river rejuvenation and conservation (RRC) has been a major enterprise undertaken in many countries including India over the past decades. Globally, there are different types of activities that have been taken up for this purpose; they are intended to restore rivers to some ideal state – not necessarily their pristine state – and conserve them thus in the foreseeable future.

Well-planned river rejuvenation/ restoration and conservation activities begin with clearly defined objectives before any action plan can be prepared. In India the erstwhile Ganga Action Plan (GAP) and Yamuna Action Plan (YAP) were aimed at reducing anthropogenic pollution in Ganga and Yamuna rivers – without clearly defined objectives and yardsticks pertaining to the state of the rivers themselves. Other major rivers were also addressed likewise through the National River Conservation Plan (NRCP). Subsequently, the Ganga River Basin Management Plan (GRBMP-2015) prepared by the Consortium of 7 IITs (IITC, in short) was aimed at ***restoring the wholesomeness of River Ganga*** as per the government's mandate. In 2014, the Indian government initiated the Namami Gange programme for rejuvenating and conserving National River Ganga. GOI's flagship Namami Gange programme stands out as the government's best river conservation effort so far with a consolidated medium-term fund and a dedicated implementing agency namely, the National Mission for Clean Ganga (NMCG). The Namami Gange programme was approved as 'Flagship Programme' by the Government in June 2014 with a budget outlay of Rs. 20,000 Crore for effective abatement of pollution, conservation and rejuvenation of River Ganga *[Ref: DWRRD&GR, GOI, 2023 viz. https://jalshakti-dowr.gov.in/namami-gange-2/ dated March 2, 2023 – Accessed 10-09-2024]*.

AIMS & OBJECTIVES OF NMCG

The declared aims and objectives of NMCG are to accomplish the mandate of National Ganga River Basin Authority (NGRBA):

Box 1: Thames River Basin Management Plan:
Objectives of the Thames River Basin Management Plan are Environmental objectives that include broadly:
1. Waterbody status objectives
2. Protected area compliance objectives
3. Biodiversity objectives

Box 2: Rhine Action Programme 2020:

Objectives of the Rhine Action Program 2020 are for sustainable river management, specifically:

1. **Enhanced Flood Protection:** Recognizing the impact of major floods in the 1990s, Rhine 2020 aimed to give the river "more space" by restoring natural floodplains, which would mitigate flood risks while enhancing ecosystems.
2. **Ecosystem and Biodiversity Restoration:** Efforts to reintroduce migratory species continued, with an expanded focus on habitat restoration. The program sought to ensure the natural migration of fish to spawning grounds without human intervention.
3. **Groundwater and Sediment Management:** Improved groundwater protection and sediment quality were targeted, focusing on reducing pollutants in river sediments and protecting the Rhine's groundwater sources.
4. **Water Quality and Emerging Pollutants:** Building on the success of the APR, Rhine 2020 added new targets to address emerging pollutants, such as pharmaceuticals and microplastics, through enhanced monitoring and regulatory controls.
5. **Public and Stakeholder Engagement:** To sustain long-term progress, Rhine 2020 emphasized community involvement, encouraging environmentally responsible behaviours and participation from local businesses and residents.

1. To ensure effective abatement of pollution and rejuvenation of the river Ganga by adopting a river basin approach to promote inter-sectoral co-ordination for comprehensive planning and management.
2. To maintain minimum ecological flows in the river Ganga with the aim of ensuring water quality and environmentally sustainable development.

As is evident, the above stated aims and objectives of NMCG are multiple, somewhat overlapping, and not all of them are related to river rejuvenation and conservation. For instance, "abatement of pollution" would itself improve river "water quality"; moreover, maintaining "minimum ecological flows" for "water quality" are unrelated since ecological flows are required for ecological purposes and not for some assumed water quality requirement. We therefore need to be clear about the objectives of RRC and the criteria for assessing the fulfilment of these objectives.

In IWIS-2022 it had been proposed that restoration and maintenance of indigenous aquatic life and riparian vegetation akin to pre-industrial and pre-urbanization era (reference condition) reflects the bio-physical status of healthy rivers in different stretches (from origin to destination), and that these conditions be adopted as a guiding principle for reference conditions (or target conditions) of healthy rivers for RRC. IWIS-2022 had deliberated extensively on river health and concluded that biological profiling of rivers at different spatio-temporal scales, output-based considerations in terms of river ecosystem services, and people's perceptions of what constitutes a healthy river should be adopted to assess the present and reference conditions of rivers. Biological profiling may also need to be qualified with other aspects such as dissolved oxygen in some cases. But, very often, just a few typical river species such as fishes and macro-invertebrates, can adequately describe river conditions in specific stretches rather than a host of water quality measurements. Thus, the recommendations of IWIS-2022 were:

1. Best Use Water Quality Criteria are not suitable for assessing River Rejuvenation and Conservation (RRC) efforts.
2. River Health (RH) is an appropriate concept to assess RRC efforts. The specific parameters and aspects to be included in RH may encompass rivers' biological profiles, ecosystem services, and people's perception of river health.
3. Indigenous aquatic life and riparian vegetation akin to pre-industrial and

Box 3: Danube River Basin Management Plan:

The core objectives of the Danube River Basin Management Plan include:

1. **Water Quality Improvement:** To meet European Union (EU) standards for chemical and ecological status, focusing on reducing pollutants and nutrient loads.
2. **Hydrological and Morphological Integrity:** Ensuring River and habitat continuity, restoring wetlands, and managing hydrological alterations.
3. **Biodiversity and Habitat Protection:** Addressing invasive species and preserving habitats for native flora and fauna.
4. **Climate Change Adaptation:** Developing strategies to address climate impacts on water resources, focusing on both drought and flood risks.

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Box 4: Murray-Darling Basin Plan (MDBP):

1. Water Recovery

The plan aims to recover water from consumptive uses (agriculture, industry, towns) to maintain ecological health through two key targets:

- **Bridging the Gap:** Recovering 2,750 GL per year, later adjusted to 2,075 GL following the Northern Basin Review.
- **Enhanced Environmental Outcomes:** An additional recovery of 450 GL to be achieved by 2027 through water-saving infrastructure and environmental projects.

2. Sustainable Diversion Limits (SDLs)

- The MDBP introduces SDLs to cap how much water can be extracted from the basin's rivers and aquifers for consumptive purposes, ensuring enough water remains for the environment. SDLs cap the amount of water that can be extracted for agricultural, industrial, and domestic purposes.

3. Environmental Water Management

- The plan targets improved water delivery to key ecosystems, such as wetlands, river systems, and floodplains, to ensure ecological resilience and biodiversity.

4. Climate Adaptation and Resilience

- Recognizing the impacts of climate change, the Basin Plan includes provisions for adapting water management strategies to account for shifting rainfall patterns, more frequent droughts, and temperature changes.

5. First Nations Involvement

- The Plan also prioritizes integrating First Nations' knowledge and values into water resource management and ensuring their cultural connection to water is respected.

pre-urbanization era may be adopted as a simplified reference condition reflecting the bio-physical status of healthy rivers in different stretches.

Now a healthy river is one that has hydrological, chemical, geological, spatial, and ecological integrity (vide IWIS-2022). Rivers impacted by human activities in the basin – and sometimes within the river channels themselves – may lose some of their functional capabilities, which compromises their integral nature. River restoration, therefore, is necessarily the means to make such rivers functionally able (or capable) once again to fulfil their natural bio-physical processes and functions that ensure optimal ecosystem services for human benefits. This leads to the Samarth Ganga (that is, "Able Ganga") framework (applicable to River Ganga or any other river) as depicted in Figure 1. The adoption of this framework (with its 5 pillars of Aviral Dhara, Nirmal Dhara, Arth Ganga,

When compared with RRC efforts of other major rivers in the world (like the Thames, Rhine, Danube or Murray-Darling rivers in Europe and Australia), it is evident that, while they may have multiple objectives, especially to maximize specific ecosystem benefits from these rivers, the one common and basic objective is to restore river health without which the other objectives would be in jeopardy.

Jan Ganga and Gyan Ganga) together with the clearly defined objectives of healthy rivers can ensure successful RRC.

When compared with RRC efforts of other major rivers in the world (like the Thames, Rhine, Danube or Murray-Darling rivers in Europe and Australia), it is evident that, while they may have multiple objectives [*refer Boxes 1 to 4*], especially to maximize specific ecosystem benefits from these rivers, the one common and basic objective is to restore river health without which the other objectives would be in jeopardy. This is essentially the same as recommended in IWIS 2022 for Indian rivers. Similarly, the five pillars of the Samarth Ganga Framework can be also seen embedded in their RRC plans in various ways. Thus, while Aviral Dhara and Nirmal Dhara are reflected in their flow regime (quantitative) and water quality targets, the other three pillars are adopted through realistic water pricing, economic water use incentives, wide public consultations, shared public involvement in RRC efforts, and regular – almost continuous – updating of river data, river status and RRC action plans in open access platforms/ forums.

Considering the above issues, this session of IWIS-2024 will deliberate upon:

a) The need for clearly defined objectives and framework for successful and verifiable river rejuvenation and conservation.
b) The relevance and robustness of an Indian framework vis-à-vis various global frameworks for successful and verifiable river rejuvenation and conservation.

DISCUSSIONS

Discussion was led by Dr. Vinod Tare, cGanga, IIT Kanpur and Mr. Asok Kumar, Former Director General, NMCG regarding river conservation, the Ganga River Basin Management Plan (GRBMP), and the Samarth Ganga framework:

1. INTRODUCTION AND CONTEXT:

- Dr. Vinod Tare welcomes participants to a summit focused on preparing the second version of the Ganga River Basin Management Plan and river basin management plans for six other rivers (under the CAMP project).
- Mr. Asok Kumar, former Director General of the National Mission for Clean Ganga

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(NMCG) and Chairman of the National Water Mission, is highlighted for his contributions, including the "catch the rain where it falls and when it falls" slogan and the Jal Shakti Kendras initiative.

- The session aims to brainstorm and gather feedback on the proposed framework and objectives for river restoration and conservation.

2. GLOBAL PRACTICES AND THE SAMARTH GANGA FRAMEWORK:

- The discussion references global river basin management practices, including examples from the Thames, Rhine, Danube, and Murray-Darling rivers.
- The primary objective is to learn from international practices and adapt them to Indian conditions.
- The Samarth Ganga framework is introduced as a result of extensive discussions and is now under review for potential gaps or improvements.
- The core question is whether the Samarth Ganga framework is the right approach for India.

3. OBJECTIVES OF RIVER RESTORATION AND CONSERVATION:

- The central objective is to restore and conserve rivers in a way that maintains indigenous aquatic flora and fauna within the river space.
- This objective aligns with global practices that prioritize reviving the ecosystem and ensuring the survival of local biological profiles.
- Different river basins use different indicators to monitor progress (e.g., diatoms in the Thames).
- The specific biological forms to monitor vary depending on the river stretch (e.g., Snow Trout/Mahseer in colder regions, Indian major carbs/dolphins in plains).
- The abiotic components (habitat, water quality) must support the survival of these key biological forms.

4. EVOLUTION OF OBJECTIVES FROM THE GANGA ACTION PLAN (GAP) TO NAMAMI GANGE:

- The Ganga Action Plan initially focused on improving water quality based on "designated best use practices" (Class A, B, C).
- Through discussions, the focus shifted to water quality suitable for indigenous aquatic life rather than human consumption.

- River health, defined as the return of local biological forms, is adopted as the primary criterion for monitoring progress.
- The reference point for "indigenous" life is set as the pre-industrial era (post-independence) to balance idealism with practicality.
- The concept of "Samarth Ganga" emphasizes maintaining the river's natural capabilities and processes.

5. KEY PILLARS OF THE SAMARTH GANGA FRAMEWORK:

- **Aviralta (Continuous Flow):** Ensuring the river flows.
- **Nirmalta (Cleanliness):** Maintaining water quality suitable for local life forms.
- **Jan Ganga (Public Participation):** Engaging the public in river conservation.
- **Gyan Ganga (Knowledge):** Creating and sharing knowledge about the river system.
- **Arth Ganga (Economics):** Ensuring that river restoration contributes to the economy (as per the Prime Minister's vision).

6. ENABLERS FOR ACHIEVING THE FRAMEWORK:

- Science and technology.
- Appropriate policies, laws, regulations, and governance mechanisms.
- Economics and financing.
- Public participation.

7. ESSENTIALS FOR RIVER RESTORATION:

- Political will at all levels.
- Public spending on infrastructure (sewer networks, STPs).
- Partnerships and collaboration.
- Perseverance and sustained effort.
- Convergence between various programs (Namami Gange, Jal Jeevan Mission, Swachh Bharat Mission).

8. MR. G ASOK KUMAR'S CONTRIBUTIONS AND PERSPECTIVES:

- Highlights the shift from engineering-focused solutions to people-centric solutions with the Arth Ganga concept.
- Emphasizes the importance of floodplains,

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sediment management, and river morphology in river health.

- Discusses the impact of climate change on river flow patterns and the need for rainwater harvesting.
- Addresses the challenges of solid waste pollution and the need for policy interventions.
- Advocates for navigation as a potential use of rivers.
- Notes the increased water usage and dam construction impacting river flow.
- Shares the global recognition of the Namami Gange program and its framework.
- Suggests adding people's participation and technology for monitoring as key components.
- Explains the PRAYAG system for real-time monitoring of STPs.
- Details the six pillars of Arth Ganga: natural farming, generating funds for ULBs, livelihood creation, culture and heritage, institution building, and capacity development.
- Stresses the importance of institution building and capacity development for sustainable river management.
- Highlights the political commitment to river cleaning.

9. DISCUSSION AND KEY QUESTIONS:

- The central question is whether the proposed framework and objectives are suitable and holistic.
- Participants are asked to identify any

Arth Ganga: Aims to link river restoration with economic benefits for local communities through contribution in GDP growth. Calls for people's participation, appropriate approach and technology in monitoring and addressing pollution of various kinds by "not one size fits all" concept.

divergences or missing elements in the framework.

- The focus is on the core objective of maintaining the river's capabilities and ensuring the return of indigenous flora and fauna.
- The discussion explores the relationship between human behaviour and river health.
- The importance of addressing climate change and disaster risk resilience is raised.
- The challenges of data sharing and coordination among multiple agencies are discussed.
- The meaning and scope of public participation are debated.
- The concept of "land for rivers" and its inclusion in the framework is explored.
- The need to move from human-centric to river-centric approaches is emphasized.
- The importance of site-specific solutions and avoiding standardized water quality numbers is highlighted.

The discussion focused on defining the objectives and framework for effective river rejuvenation and conservation, particularly for the Ganga River emphasizing the importance of learning from global practices while adapting them to the Indian context. Key to the discussion is the Samarth Ganga framework, which aims to ensure that human interaction with rivers does not diminish the river's inherent capabilities and functions.

KEY POINTS

Global Practices: The discussion references examples from other river basins like the Thames, Rhine, Danube, and Murray-Darling to understand international approaches to river restoration.

Objective: Retaining River Capability (Samarthya): The central objective is to maintain the river's natural functions and processes, ensuring its "Samarthya." This is measured by the return and thriving of indigenous aquatic flora and fauna.

Shifting from Human-Centric to River-Centric: The approach emphasizes the needs of the river ecosystem rather than solely focusing on human uses.

Framework Pillars: The Samarth Ganga framework consists of five pillars: Aviral Ganga (continuous flow), Nirmal Ganga (clean water), Gyan Ganga (knowledge and research), Jan Ganga (public participation), and Arth Ganga (economic benefits from river restoration).

Public Participation: The discussion stresses the importance of genuine public involvement, going beyond symbolic actions to include active participation in monitoring, decision-making, and holding authorities accountable.

Arth Ganga: Aims to link river restoration with economic benefits for local communities through contribution in GDP growth. Calls for people's participation, appropriate approach and technology in monitoring and addressing pollution of various kinds by "not one size fits all" concept. This warrants situation specific

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norms as against nationwide or even river basin wide uniform standards that will allow an appropriate combination of nature-based options and most advance technologies in phased manner by setting programmatic goals given resource and time constraints fitting into a larger cycle of River Basin Management Plan.

Climate Change: The impact of climate change on river systems is acknowledged, and the need for adaptation strategies is discussed.

Data Sharing and Coordination: Participants raised the challenge of data sharing and coordination among different agencies involved in river management.

Equity: The discussion touches on the equity implications of river management projects, such as the use of taxpayer money for urban sewage treatment plants.

Land for Rivers: The importance of allocating adequate land for riverine ecosystems is highlighted.

KEY TAKE AWAY POINTS

- The primary goal is to preserve the river's natural functions ("Samarthya"), as evidenced by thriving native flora and fauna.
- A shift from a human-centric to a river-centric approach is crucial.
- The Samarth Ganga framework provides a structure for river restoration efforts.
- Public participation is vital, requiring genuine involvement, not just symbolic actions.
- The Arth Ganga concept links river health to economic benefits for communities.
- Climate change impacts and adaptation must be considered.
- Improved data sharing and coordination among agencies are essential.
- Equity in resource allocation and project benefits needs careful consideration.
- Adequate land allocation for river ecosystems is necessary.
- The Indian framework is holistic, comprehensive and adapting to local conditions, differing from European models.

GIST

The core of the discussion revolves around establishing a clear and robust framework for river conservation, with a focus on maintaining the river's inherent capabilities and ensuring the return of indigenous aquatic life. The Samarth Ganga framework, with its five pillars, is in general accepted as a comprehensive approach, but the discussion also acknowledges the need for providing details and adaptation to specific local contexts.

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December 04 - 06, 2024

Enablers for River Rejuvenation and Conservation (RRC) I: Science & Technology

Day 2:
Thursday; December 5, 2024
1130 – 1300 hrs

Chair: **Mr. G Asok Kumar**
(IAS Former DG, NMCG & Honorary Senior Fellow, CPR)

Moderator: **Dr. Vinod Tare**
(Former Professor, Founder & Advisor, cGanga, IIT Kanpur)

Panelist/ Lead Discussant:
Dr. Pranab Kumar Mohapatra (IIT Gandhinagar)
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Dr. Minakshee Mahananda (NIT Rourkela)
Dr. Priyank Sharma (IIT Indore)
Dr. B Sridharan (IIT Palakkad)
Dr. Uday Bhonde (National Institute of Urban Affairs, New Delhi)
Dr. Anshumali (IIT (ISM) Dhanbad)
Mr. Suresh Babu (WWF-India)
Dr. Ashwini Keskar Sardeshmukh (Pune Knowledge Cluster)
Dr. Nupur Bahadur (TERI, New Delhi)
Mr. Anshuman (TERI, New Delhi)
Mr. Prabhash Kumar (SMCG, UP)
Mr. Sandeep Chauhan (cGanga, IIT K)
Mr. R K Jain (Uttarakhand Peyjal Nigam, Haridwar)
Dr. Ashwini Mirajkar (NIT Nagpur)
Dr. Suresh Kumar Thappeta (NIT Nagpur)
Mr. Amit Kumar (SMCG Jharkhand)

SETTING THE SCENE

Formulating the objectives and framework for river rejuvenation and conservation (RRC) is the first necessary step for devising a coherent River Basin Management Plan (RBMP) with milestones and verifiable parameters to measure its success over time. Developing RBMP is a cyclic process as depicted in Figure 2. But to make and implement a plan requires the enablers to make it successful. The enablers needed for RRC include several components that have been mentioned in previous Summits, viz. Science, Technology, Policy, Laws/ Regulations & Governance, Economics, Financing, and Public Participation

River ***Science*** as a field of study gained ascendancy over the last few decades with the concept of rivers as natural ecosystems that combine geological, climatic, hydrological, ecological and other processes such that they have their unique dynamics that govern rivers in all their diversity. That is, even though details of river processes may vary over time and space for any river and from one river to another, their functioning can be understood sufficiently given their spatial-temporal contexts. Knowledge of the science of rivers is therefore crucial to understand not only how a healthy river may degrade but also how a degraded river can be rejuvenated and conserved.

To use the above understanding of why and how a river degrades and how it can be rejuvenated needs practical tools and methods for field applications. Such methods and tools constitute the technological arsenal for restoring a moribund or degraded river into a healthy and vivacious one that fulfils all the essential functions of rivers as we understand them – in much the same way that a car damaged in a road accident is repaired in a workshop to make it run satisfactorily again. A car is, however, only a manmade device that will

River Basin Management Plan: An Embedded Cyclic Process

- Understanding
- Communication
- Negotiation
- Strategizing
- Formulating Policies
- Legislations
- Planning
- Identification of Responsive Agencies, Institutions, Individuals, etc. & Mobilization of Resources
- Design & Implementation
- Incentives, Governance & Regulation
- Monitoring & Feedback

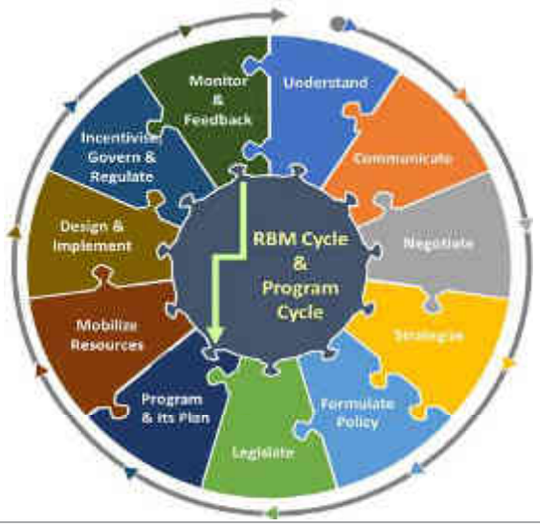

Figure 2: River Basin Management Planning Cycle vis-à-vis Programme Cycle

perforce deteriorate and become irreparable over time, whereas a river is a natural ecosystem that has an indefinite life unless irreparably damaged by natural or manmade causes. Science and technology can help us assess the state of a river and provide the theoretical and physical means for its revival and conservation.

ISSUES/ QUESTIONS

i) To what extent have RRC activities in India been based on science understanding and technological inputs?
ii) What is the contribution of Science & Technology in successful river conservation in India to the extent that they have been used?
iii) What further national and global inputs of Science & Technology for RRC can be envisaged at this point of time, and how can they be acquired?
iv) What incentives or facilitations may be needed to expand scientific knowledge and technological means for RRC in India?

DISCUSSIONS

The discussion in the second session focused on the role of science and technology and other enablers in achieving the objectives and adopting the framework for river conservation:

1. RECAP OF THE FIRST SESSION AND INTRODUCTION TO ENABLERS:

- Dr. Vinod Tare begins by recapping the first session, which focused on establishing the right objectives and framework for river restoration and conservation (Samarth Ganga framework).
- The second session shifted to exploring how different enablers can facilitate the achievement of these objectives and the adoption of the framework.
- The primary focus of this session was on the role of science and technology, with the understanding that policies, laws, regulations, economics, and financing will be discussed in subsequent sessions.

2. THE ROLE OF SCIENCE AND TECHNOLOGY (GYAN GANGA):

- Dr. Tare emphasized the importance of "Gyan Ganga" (knowledge) as a crucial enabler.
- This includes developing a strong understanding of various aspects of the river system, such as river space, flows, hydraulics, geomorphology, water quality, sediment loads, pollution, biota, etc.
- Equally important is the communication of this knowledge to all concerned stakeholders.

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Enablers for River Rejuvenation and Conservation (RRC) I: Science & Technology



- Scientific evidence and proper knowledge are essential for meaningful negotiations regarding the limited resources of a river basin. The lack of such evidence hinders the resolution of disputes related to sharing of river resources, including water.
- The role of scientists and technologists is to create evidence and knowledge to facilitate this negotiation process by ensuring everyone is informed.

3. RIVER BASIN PLANNING CYCLE VS. PROGRAM CYCLE:

- Dr. Tare distinguished between the river basin planning cycle (a long-term, cyclical process involving understanding, communication, negotiation, strategizing, policy formulation, planning, implementation, monitoring, and feedback) and the program cycle (shorter-term implementation of specific interventions).
- He expressed concerns on wheather India has a robust program cycle with clearly defined goals commensurate with allocated resources (e.g., the Rs 20,000 crore for Namami Gange).
- The need for periodic review and goal resetting within the program cycle is highlighted.
- The crucial question is whether the returns and impact of the money spent align with the initial promises and objectives.

4. SETTING REALISTIC GOALS AND TIMELINES:

- Dr. Tare argues for setting realistic, short-term goals (e.g., for five-year periods) that contribute to the long-term objective of river restoration.
- He uses the analogy of a journey, where reaching the destination (restored river) will take decades, but interim milestones should be defined and tracked based on available resources.
- The importance of clear terminology (river basin management plan vs. program cycle) is stressed.
- Programs should have clear promises of what

will be achieved with allocated funds within a specific timeframe.

5. FORTY YEARS OF EXPERIENCE AND LESSONS LEARNED:

- Dr. Tare reflects on the 40 years since the initiation of the Ganga Action Plan in 1985, noting that the public perception of tangible improvements is still limited.
- He emphasizes that river restoration requires a comprehensive and inclusive approach, with all related programs (Namami Gange, Swachh Bharat, Jal Jeevan Mission) working collectively towards a single goal.
- The shift in terminology from "wastewater" to "used water" and the concept of reuse/recycling are discussed, highlighting the need for a clear understanding of these terms.
- The fundamental question remains: are we getting value for the public money spent on river rejuvenation and conservation?
- The session aims to learn from past experiences (both successes and failures, including criticisms from the Supreme Court and NGT) to strategize for the future.

6. CHALLENGES AND OPPORTUNITIES IN ADOPTING SCIENCE AND TECHNOLOGY (PERSPECTIVE OF MR. G ASOK KUMAR, FORMER DG, NMCG):

- Mr. Asok Kumar emphasized the difference between academic/theory and practical implementation on the ground.
- He points out that cleaning a flowing river is different from repairing a road, requiring a holistic approach across the entire river basin.
- The conditions and standards for river quality are often set by academics and authorities (CPCB), and implementing agencies are tasked with meeting them, even if the rationale behind specific standards (e.g., BOD < 3mg/L) is unclear.
- Regarding the reuse of treated water, he notes

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that the maximum water usage is in irrigation, suggesting that treated water could be used for this purpose, potentially with less stringent nutrient removal standards.

- The absorptive capacity of Urban Local Bodies (ULBs) to implement and manage treatment infrastructure is a significant challenge.
- Bureaucracy and the fear of repercussions can hinder the adoption of innovative technologies. Organizations like cGanga should support administrative decision-making in this regard.
- He shares a practical example of bureaucratic hurdles in trying to release treated water into the Yamuna to improve flow, highlighting the disconnect between theoretical solutions and on-the-ground realities.

7. CONVERGENCE AMONG ACADEMICIANS AND A HOLISTIC APPROACH:

- Dr. Tare stresses the need for convergence among academicians to provide clear and unified recommendations to the government.
- He highlights the importance of a comprehensive assessment of reuse policies, considering transportation costs and the overall impact.
- The necessity of urban river management plans at the city level is emphasized, focusing on water balance and management within the city as a prerequisite for river cleanup.
- The session's goal was to collectively learn from the past and strategize for the future, with CAMP institutions playing a crucial role in providing consolidated recommendations.

8. PERSPECTIVES FROM OTHER PARTICIPANTS:

- **Dr. Nupur Bahadur (TERI):** While treated water should be given to rivers for ecological balance, reuse in thermal power plants and railways is also important for water conservation. The

parameters for reuse should be context specific.

- **Mr. B Sengupta:** Focus should be on treating 100% of sewage with at least primary and secondary treatment before focusing on advanced treatment. Non-point source pollution (pesticides, toxic metals from agriculture) needs to be addressed. Agriculture water uses efficiency needs significant improvement, involving the Ministry of Agriculture.
- **Unidentified Participant:** Many water treatment solutions exist, but the gap lies in the government's demand for 100% immediate performance, which bio-processes cannot deliver. A phased approach with acceptance of 80-90% improvement initially is needed.
- **Dr. Anshuman (TERI):** Science should be used for managing water balance and allocation based on priorities. Stakeholder prioritization and economic viability are crucial for the adoption of interventions. A holistic approach to water quality parameters is needed, including emerging pollutants and plastics, with norms based on dose-response relationships. Democratizing technology and capacity building at the local level are important for effective implementation.
- **Prof. Vikrant Jain (IIT Gandhinagar):** The focus should shift from absolute numbers and standards to a more nuanced understanding of

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river processes (geomorphology, floodplains, sediment transport) and scenario building for gradual improvement.

9. CONCLUSION AND WAY FORWARD:

- Dr. Tare concludes by emphasizing the need for a comprehensive understanding of water balance and reuse and closing the water and solids loop at appropriate scales.
- Urban river management plans are crucial, focusing on water management within cities.
- The responsibility of CAMP institutions to provide collective and actionable recommendations to the government is reiterated.
- The importance of moving beyond conflicting opinions and working together step-by-step towards long-term goals is stressed.
- The session concludes with a transition to subsequent sessions focusing on policy, law, governance, and river monitoring technologies.

Summarising, the second session of the summit focused on leveraging science and technology to achieve river rejuvenation objectives and implement the established framework. The discussion highlighted the crucial role of knowledge creation and dissemination for informed decision-making and negotiation in water resource management. The difference between the river basin management plan cycle and the program cycle was emphasized, advocating for clear, achievable goals with allocated resources for each program. Participants discussed the need for context-specific water quality norms, the complexities of water reuse, and the challenges in adopting new technologies due to bureaucratic hurdles and risk aversion. The session also touched upon the importance of integrated planning, addressing emerging pollutants, democratizing technology, and the necessity of convergence among academics and implementing agencies.

GIST

This session explored how science and technology can be effectively utilized to achieve river conservation goals. Key themes included the need for evidence-based decision-making, setting realistic program objectives with defined resources, adapting global standards to local contexts, understanding the nuances of water reuse, overcoming barriers to technology adoption, and fostering collaboration among stakeholders. The discussion underscored the importance of a holistic approach that considers local conditions and involves all relevant parties in the process.

KEY TAKE AWAY POINTS

- **Knowledge is Key:** Robust scientific understanding and effective communication are essential for informed decision-making and resolving water resource issues.
- **Program Cycles Matter:** River rejuvenation programs should have clear, measurable goals tied to allocated resources with periodic reviews to assess progress.
- **Context-Specific Standards:** Water quality norms should be scientifically sound and tailored to local river ecosystems rather than blindly adopting international standards.
- **Rethink Reuse:** The concept of water reuse needs a comprehensive assessment considering costs, benefits, ecological impacts, and appropriate scales of implementation.
- **Overcome Adoption Barriers:** Bureaucracy and risk aversion hinder the adoption of innovative technologies; collaboration and shared responsibility are needed.
- **Integrated and Holistic Planning:** River conservation requires a multi-faceted approach that considers water balance, emerging pollutants, and the interconnectedness of urban and river health.
- **Democratize Technology:** Empowering local communities with knowledge and technology can enhance the sustainability and scalability of solutions.
- **Foster Convergence:** Collaboration and consensus among academics, implementing agencies, and other stakeholders are crucial for effective action.
- **Learn from the Past Critically:** Analyse past efforts (like the Ganga Action Plan) to identify lessons and strategize for future improvements, focusing on impact and value for money.
- **Start with Realistic Steps:** Break down long-term goals into achievable short-term targets with limited resources to demonstrate progress and build momentum.

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Enablers for River Rejuvenation and Conservation (RRC) II: Policy, Laws, Regulations & Governance

Day 2:
Thursday; December 5, 2024
1400 – 1530 hrs

Chair: **Mr. Rajiv Ranjan Mishra** (Former DG, NMCG)

Moderator: **Dr. Indrajit Dube** (Vice Chancellor, National Law University Meghalaya)
Dr. Manoj Tiwari (Professor, IIT Kanpur)

Panelist/ Lead Discussant:
Dr. N V Umamahesh (NIT Warangal)
Dr. Santosh G Thampi (NIT Calicut)
Dr. S K Singh (MBM University Jodhpur)
Mr. Suresh Babu (WWF-India, New Delhi)
Dr. Nupur Bahadur (TERI, New Delhi)
Dr. S P Singh (IIT Roorkee)
Mr. Prabhash Kumar (SMCG, UP)
Mr. Sundeep Chauhan (cGanga, IIT Kanpur)
Mr. R K Jain (Uttarakhand Peyjal Nigam, Haridwar)
Mrs. Meenakshi Mittal (Uttarakhand Peyjal Nigam, Haridwar)
Dr. Ashwini Mirajkar (NIT, Nagpur)
Dr. Suresh Kumar Thappeta (NIT, Nagpur)
Mr. Amit Kumar (SMCG, Jharkhand)

SETTING THE SCENE

Scientific and technological knowledge for rejuvenating and conserving rivers can be put to proper use in the social and national context only when enabled or facilitated by suitable government measures. They include appropriate policies, laws/ regulations, governance systems and institutional mechanisms for reliable data collection, prioritisation of ecosystems' conservation – and specifically for river conservation – that define the scope for participation of local governments such as municipalities for urban localities and Gram Panchayats for rural areas, non-government agencies, industry and businesses, and general citizens, and adopting comprehensive governance principles of performance and accountability.

As of now there seem to be few policies or overarching laws that directly address rivers. However, many government policies – especially concerning important socio-economic sectors and environmental aspects – may relate to rivers indirectly insofar as they partially or marginally concern rivers. How these policies are interpreted for rivers by various stakeholders and government agencies and how effectively such laws and regulations are implemented on the ground by government authorities may be variable. The governance standards and institutional frameworks adopted for RRC may also be variable across the country with significant scope for improvement in many parts.

In view of the above aspects concerning policies, laws and governance, several issues need to be streamlined regarding the enablers available for river conservation in India, viz.:

i) What are the important policies in India and elsewhere in the world that directly or indirectly concern river conservation?
ii) What additional policies or changes in existing policies are needed for river conservation in India?
iii) What are the important laws and regulations in India that directly or indirectly concern river conservation?
iv) What changes or new laws/ regulations are needed for river conservation in India?
v) What measures or yardsticks should be used for assessing the quality of governance for river conservation in India?

The Consortium of 7 IITs (IITC) while preparing Ganga River Basin Management Plan (GRBMP-2015) deliberated at length through the thematic group on Policies, Laws and Governance (PLG) on all the above issues. After a thorough review of policies, laws and regulations since the pre-independence era until the recent times of local, state and central government (refer Summary of GRBMP Thematic Reports in Appendices II & III; Volume 1: Main Plan Document; GRBMP by cGanga & NMCG, 2015) IITC proposed setting up a National River Ganga Basin Management Commission (refer Appendices IV; Volume 1: Main Plan Document; GRBMP by cGanga & NMCG, 2015) through an act of

The governance standards and institutional frameworks adopted for RRC may also be variable across the country with significant scope for improvement in many parts.

Indian Parliament based on the draft of the National River Ganga Basin Management Bill, 2015 (refer Appendices IV; Volume 1: Main Plan Document; GRBMP by cGanga & NMCG, 2015). Government of India, however, issued River Ganga (Rejuvenation, Protection and Management) Authorities Order, 2016 and declared National Mission for Clean Ganga (NMCG) as an Authority. National Ganga River Basin Authority (NGRBA) was dissolved and National Ganga Council (NGC) chaired by the Prime Minister of India was set up as an apex body for implementation of Namami Gange Programme. Subsequently, State Mission for Clean Ganga (SMCG) and District Ganga Committees were created for some of the Ganga Basin States and Districts respectively to facilitate implementation of the Namami Gange Programme. Since preparation of GRBMP 2.0 is at an advance stage, it is warranted that efficacy of existing policies and governance model be thoroughly discussed amongst concerned stakeholders.

The third thematic session of this India Water Impact Summit (IWIS) 2024, thus, is intended to discuss the prevailing Policy, Laws, Regulations & Governance as an important enabler for RRC to explore the future of river basin management in India. With growing ecological and water security challenges, this session aims to address key questions on structural, legal, and

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policy frameworks for effective governance. The focus will centre on three critical aspects: the structure of basin authorities, their mandate, and the legal framework for their establishment.

1. STRUCTURE OF RIVER BASIN AUTHORITY/COMMISSION

A central discussion will revolve around whether India's river governance should be unified under a single national authority or managed by multiple basin-specific commissions. This debate is particularly relevant given the diversity of India's river systems–from the Ganga to mountain streams and peninsular rivers. Participants will deliberate on how to balance administrative cohesion and localized needs through appropriate governance models.

A key sub-question will be whether administrative boundaries (state divisions) or natural hydrological boundaries (river basins and sub-basins) should define the jurisdiction of these authorities. Aligning with natural boundaries could allow for integrated water management, ensuring ecological continuity and efficient resource allocation. However, it poses challenges of inter-state cooperation and institutional alignment.

SUB-QUESTIONS:

- How the requirement of authority structure considering natural boundaries (River Basin Authority for lower order river to higher order rivers in a basin) for planning, studies, and as custodian purposes could be in sync with administrative

Acting as a regulator, the authority could enforce water-use norms, manage disputes, and ensure compliance with water quality standards or other river conservation criteria.

boundaries (from local governments to central government) for ground level interventions?

- How two parallel governance structures, one with natural boundaries and the other with administrative boundaries, can be created in a hierarchical pattern?
- Is it possible to have two parallel governance structures, and what mechanism and/or means are required for effectiveness of river restoration and conservation programmes?
- How can a governance structure based on hydrological units (e.g., Ganga Basin, Brahmaputra Basin) prevent inter-state conflicts over water rights?
- What should be the role of regional stakeholders–local governments, civil society, industry and businesses, and river-based communities–in a multi-level authority structure?

The session will also explore international models such as the Danube River Commission, which transcends national borders, and the Murray-Darling Basin Authority of Australia, known for balancing local needs with national objectives.

2. NATURE AND MANDATE OF THE RIVER BASIN AUTHORITY/COMMISSION

Determining the scope of authority is critical for effective governance. The discussion will address whether the proposed basin authority should focus solely on policymaking or also act as a planning, regulatory and/or implementation body. Different governance models present distinct trade-offs:

a) Policy Mandate: A policy-oriented body can frame water-use strategies, issue guidelines on environmental flows, and recommend conservation frameworks.
b) Regulatory Mandate: Acting as a regulator, the authority could enforce water-use norms, manage disputes, and ensure compliance with water quality standards or other river conservation criteria.
c) Implementation Mandate: A basin authority may also oversee project implementation, managing infrastructure like dams, irrigation systems, and treatment plants.
d) Dual Governance: Alternatively, the National Mission for Clean Ganga (NMCG) or similar bodies could handle

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implementation, with the basin authority focused on regulation and policy oversight.

SUB-QUESTIONS:

- Should implementation agencies be independent of the regulatory commission?
- How can accountability be ensured across multiple agencies with overlapping mandates?
- Can the authority act as a neutral arbiter in disputes between states or regions?

3. CONSTITUTIONAL AND LEGISLATIVE FRAMEWORK

The legal foundation of the river basin authority raises complex constitutional questions. Water is listed under Entry 17 of the State List, but Entry 56 of the Union List allows Parliament to legislate on matters concerning inter-state rivers. This creates a duality that requires careful legal resolution.

The session will explore whether a constitutional amendment is necessary to establish basin authorities with binding powers or if parliamentary legislation–perhaps through a reformed River Boards Act, 1956–would suffice. The legal framework must balance state autonomy with national priorities to prevent conflicts.

SUB-QUESTIONS:

- How can state governments be incentivized to cooperate under a centralized authority?
- Should the basin authority have quasi-judicial powers to mediate disputes?
- Can a new legal framework harmonize existing national water policies with state-level regulations?

CONCLUSION

This session will explore institutional design, governance structures, and legal frameworks for sustainable river management. It will encourage participants to consider adaptable and inclusive governance models, drawing on international and national experiences. Emphasis will be placed on aligning ecological preservation with developmental needs, ensuring transparency and accountability across all levels of governance. The goal is to develop a robust and innovative framework for managing India's rivers, safeguarding them for future generations while balancing diverse stakeholder interests.

DISCUSSIONS

The discussion in the third session focused on the policy, law, and governance aspects of river conservation and management:

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1. INTRODUCTION AND CONTEXT:

- Dr. Indrajit Dube, VC, NLU, Mizoram introduced the session, highlighting that it will build upon the previous discussions about the framework and objectives for river conservation by focusing on the enablers of law, regulations, and governance.
- He acknowledged the foundational work of Mr. Rajiv Ranjan Mishra, Former, DG, NMCG in the Ganga River Basin Management Plan (GRBMP) and the Namami Gange program.
- The session aimed to explore the relevance of law, regulations, and governance in the entire river conservation process and to gather insights from experts and stakeholders.

2. THE GENESIS OF LEGAL AND GOVERNANCE CONSIDERATIONS:

- Dr. Dube recounts how the need for policy, law, and governance considerations was recognized early in the GRBMP formulation process during the period 2010 to 2015.
- The initial focus was heavily on science and engineering, but the lack of alignment in institutions, policy, and legal frameworks was identified as a major impediment to progress.
- Convincing stakeholders about the crucial role of these dimensions alongside economic and social aspects took time.
- Over the years, significant progress has been made in mapping applicable laws and understanding their fragmented nature

Aligning with natural boundaries could allow for integrated water management, ensuring ecological continuity and efficient resource allocation. However, it poses challenges of inter-state cooperation and institutional alignment.

(many being old British-era laws focused on specific functions like irrigation).

3. KEY ISSUES AND QUESTIONS RAISED:

- **Structure of River Basin Authorities/ Commissions:** What should be the structure of these bodies?
- **Nature and Mandate:** Should the authority's jurisdiction follow state administrative boundaries or the natural hydrological boundaries of the river basin?
- **Constitutional and Legislative Framework:** Does the treatment of rivers as natural boundaries necessitate constitutional amendments and independent legislation (currently, authority often operates under the Environment Protection Act)?
- **Hierarchical Governance:** How can parallel governance structures (natural vs. administrative) be created in a hierarchical pattern?
- **Policy Mandate, Regulatory Mandate, Implementation Mandate, and Dual Governance:** How can these different mandates interact effectively? Should implementation agencies be independent of regulatory bodies?
- **Accountability:** How can accountability be ensured across multiple agencies with overlapping mandates?
- **Dispute Resolution:** Can the authority act as a neutral arbitrator in disputes between states or regions?
- **Incentivizing Cooperation:** How can

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state governments be incentivized to cooperate under a centralized authority?

- **Harmonizing Policies:** Can a new legal framework harmonize the existing National Water Policy with state-level regulations?
- **Empowerment of Local Bodies:** The lack of resources and empowerment of District Ganga Committees (DGCs) at the ground level is highlighted as a major implementation challenge.

4. PERSPECTIVES AND DISCUSSIONS:

- **Mr. Rajiv Ranjan Mishra:** Emphasized the complexity of these "wicked problems" without easy solutions. The 2016 authority notification under EPA was an innovative attempt to reconcile different perspectives and provide regulatory powers. He calls for analysis of the effectiveness of this institutional structure. Policy is broader and more flexible than law. The notification mandates the formulation of a National Policy for Effective Abatement of Pollution and Rejuvenation of River Ganga. Governance involves multiple tiers (National Ganga Council, Empowered Task Force, NMCG, State Ganga Committees, DGCs). The question of managing rivers based on hydrological vs. administrative boundaries is complex, especially in a federal structure like India. The District Ganga Plan is a concept to bridge this gap. Learning from past experiences and addressing gaps is crucial. Creating an act for each river basin might be impractical; EPA served as a useful instrument. Strengthening existing institutions like DGCs is vital.
- **Dr. Manoj Tiwari:** Highlights the contradiction sometimes found in technical education (learning to build dams vs. learning about their negative



impacts). Questions whether natural or administrative boundaries should govern river management and water services. Interstate river conflicts (Cauvery) underscore the need for effective policies and laws. Policy, law, and regulations are central to facilitating the implementation of river rejuvenation programs.

- **Dr. Indrajit Dube:** Notes the impact of policy, law, and governance on river resource use and exploitation (including water withdrawal and aquatic life). Raises the question of policy and legal frameworks for bio-resources and pricing of eco-services.
- **Prof. S K Singh:** Advocated for considering natural boundaries for river administration, necessitating changes in existing acts (including the Environmental Protection Act) to accommodate diverse geographical conditions and river types (perennial vs. non-perennial). Highlighted the need to link river conservation with sand mining policies and forest boundaries. Calls for different policies/laws for different river categories.
- **Unidentified Participant I:** Questions the availability of data on drainage density in the Ganga River Basin. Emphasized the rapid disappearance of small rivers and the need for policies to restore them. Proposes a "Red River List" category and criteria akin to flora and fauna conservation. Highlighted the importance of small watersheds and their connection to civilizations and ecosystems.
- **Unidentified Participant II:** Suggests marking High Flood Levels (HFL) on riverbanks to prevent encroachment.
- **Mr. Suresh Babu:** Suggests viewing administrative and natural basin management as "nested structures"

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rather than parallel ones, with natural basin oversight and collaboration with local agencies for implementation. Emphasized the importance of dual governance where planners and regulators are separate from implementers. Stressed the critical role of local stakeholders and the need to integrate river rejuvenation into sectoral plans and policies (agriculture, urban development).

- **Mr. Ashutosh Das:** Argued that the primary limitation is the lack of harmonization between the National Water Policy and varying state water policies. Highlighted the power given to the centre under Article 262 of the Constitution for interstate rivers but its underutilization. Explains the "Harmon's doctrine" allowing upstream states to use available water freely until a conflict arises. Advocates for the concepts of "Res nullius" or "Res communis" and the public trust doctrine for river management. Criticized the current CWC practice of planning projects with limited consideration for downstream riparian rights.
- **Unidentified Participant III:** Questioned the replicability of the NMCG model in other river basins with more pronounced interstate disputes, suggesting learning from international river basin management models (Mekong, European rivers).
- **Dr. Dube:** Acknowledges the challenges of replicating the Ganga model due to the unique context of each river basin and the difficulty in achieving consensus among diverse stakeholders.

5. TAKEAWAYS AND FUTURE DIRECTIONS:

- **Alignment of Boundaries:** The fundamental challenge of aligning natural hydrological boundaries with administrative state boundaries needs careful consideration.
- **Legal Framework Evolution:** The existing legal framework, often based on old and reactive laws like EPA, may need to evolve towards more comprehensive governance structures and potentially independent legislation for river basins.
- **Institutional Clarity:** The roles and responsibilities of different governance tiers (national, state, district) and the relationship between regulatory and implementation bodies need to be clearly defined to avoid conflicts and ensure accountability.
- **Interstate Cooperation:** Incentivizing cooperation among states in river management under a centralized authority remains a significant hurdle.
- **Policy Harmonization:** Harmonizing national and state water policies is crucial for effective river conservation but faces significant challenges due to differing state priorities.
- **Creating Administrative Middle Level Body for Undertaking Studies & Planning:** It is not logical to assign the Chairperson of DGCs i.e. DM to assign multiple roles,

some of which could be referred as conflict of interest, of studies, planning, implementation and feedback and monitoring. Also, DGCs lack capacity for conducting studies and planning exercises. A middle level body chaired by the Divisional Commissioner with DM's and River Basin Experts may fill the gap.

- **Empowerment at the Local Level:** Strengthening local bodies like DGCs with resources and authority is essential for effective ground-level implementation.
- **Learning from Experience:** Analysing the successes and limitations of the Ganga model and other river management approaches (both national and international) is vital for developing effective strategies.
- **Integrated Planning:** Integrating river rejuvenation goals into the plans and policies of other relevant sectors (agriculture, urban development) is necessary for holistic progress.
- **Data and Knowledge:** Generating and sharing comprehensive data on river basin characteristics (drainage density, stream health) is crucial for informed policymaking.
- **Recognizing River's Intrinsic Value:** There is a growing sentiment towards recognizing the river as a living entity with its own rights and needs.

Summarizing, the session delved into the complex legal, regulatory, and governance landscape of river basin management in India. The discussion highlights the historical evolution of relevant laws, the challenges of fragmented legislation, and the attempts to establish effective governance structures like the National Mission for Clean Ganga (NMCG) and District Ganga Committees. Key debates revolve around prioritizing natural river boundaries versus administrative state boundaries for management, the need for a unified legal framework beyond the Environment Protection Act, the balance between state autonomy and national priorities in water governance, and the practical hurdles in empowering local implementation bodies. The session underscores the need for a more holistic and cooperative approach to river management in India.

The session concludes with a recognition of the complexities and challenges involved in establishing effective policy, legal, and governance frameworks for river conservation, emphasizing the need for continued dialogue, learning, and collaborative efforts.

GIST

The discussion centres on the difficulties of governing India's rivers effectively due to fragmented laws, conflicting state interests, and the tension between natural river ecosystems and administrative boundaries. Participants explore the evolution of governance mechanisms, the limitations of existing legal frameworks, and the challenges in achieving consensus and cooperation among states for river basin management. The need for a more integrated and empowered governance structure that respects both ecological integrity and state autonomy is a central theme.

KEY TAKE AWAY POINTS

- **Fragmented Legal Landscape:** Existing laws related to rivers are often old, sector-specific, and lack a holistic river basin perspective.
- **Natural vs. Administrative Boundaries:** Managing rivers based on natural hydrological boundaries is ideal for ecological reasons but clashes with constitutionally defined administrative state boundaries.
- **Need for Unified Framework:** There's a recognized need to move beyond the reactive and pollution-centric Environment Protection Act towards a more comprehensive legal framework for river governance.
- **State Autonomy vs. National Priorities:** Balancing the constitutional autonomy of states over water resources with overarching national river conservation priorities is a significant challenge.
- **Empowering Local Implementation:** Bodies like District Ganga Committees often lack the necessary resources and authority to effectively implement policies on the ground.
- **Importance of Cooperation and Incentivization:** Incentivizing state governments to cooperate under a centralized authority is crucial but difficult due to differing priorities and resource concerns.
- **Learning from Interstate and International Models:** While direct replication may not be feasible, learning from the governance structures of other interstate and international river basins can offer valuable insights.
- **Evolving Governance Structures:** The NMCG model is an evolving attempt at centralized governance, but its dual implementation and regulatory roles raise questions about long-term effectiveness and independence.
- **River as a Single Unit:** There's a growing consensus that rivers should be managed as single ecological and economic units, transcending administrative borders.
- **Balancing Development and Conservation:** Policies must find a balance between utilizing river resources for development and ensuring their ecological health and long-term sustainability.

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Enablers for River Rejuvenation and Conservation (RRC) III: Public Participation

Day 2:
Thursday; December 5, 2024
1600 – 1745 hrs

Moderator: Dr. Mohammad Jawed (IIT Guwahati)
Mr. Siddharth Desai (Kishor Pumps, Pune)
Dr. Manoj Tiwari (IIT Kanpur)

Panelist/ Lead Discussant:
Dr. Pranab Kumar Mohapatra (IIT Gandhinagar)
Dr. Santosh G Thampi (NIT Calicut)
Mr. Suresh Babu (WWF-India, New Delhi)
Dr. Nupur Bahadur (TERI, New Delhi)
Dr. S P Singh (IIT Roorkee)
Mr. Prabhash Kumar (SMCG, UP)
Mr. Sundeep Chauhan (cGanga, IIT Kanpur)
Mr. R K Jain (Uttarakhand Peyjal Nigam, Haridwar)
Mrs. Meenakshi Mittal (Uttarakhand Peyjal Nigam, Haridwar)
Dr. Ashwini Mirajkar (NIT, Nagpur)
Dr. Suresh Kumar Thappeta (NIT, Nagpur)

SETTING THE SCENE

Rivers are lifelines of human settlements, providing numerous goods (like water, fish, nutrients and sand) and services (like transport, drainage of wastewater and flood waters, recreation, and aesthetic and spiritual satisfaction) for human needs. Simultaneously, they can also be harmful at times by causing floods, spreading pollution and water-borne diseases, etc. The population residing in a river basin is therefore affected by rivers in multiple ways and, conversely, they affect rivers in different ways. Hence people have definite stakes in the functional conditions of rivers. Public participation in River Rejuvenation and Conservation (RRC) is therefore essential for many visible and invisible reasons: at the granular level, people's actions in river rejuvenation, river conservation, and the utilization of river goods and services influence the status of a river. Local communities often possess traditional knowledge about river ecosystems, including seasonal patterns, biodiversity, and water quality changes. Incorporating this knowledge into conservation efforts ensures context-specific and practical solutions.

The planning and implementation of RRC based on sound scientific, technological, legal, policymaking and governance mechanisms may be necessary, but they are not sufficient conditions for successful RRC. Public participation in RRC at every stage from planning to implementation is essential for achieving the desired targets. This is especially because many ground-level issues of rivers affecting people may be missed out in top-down planning and implementation processes. Thus, while overall RRC planning and implementation may be carried out by specific authorities and agencies, different components of these processes may need the active as well as passive support of people.

Managing the interplay amongst five key factors (5P's: People, Policies, Plans, Programmes & Projects; referring to adjacent illustration; Figure 3) appears to be the most crucial challenge. The single most important key element which

Public participation also encourages transparency & accountability in river management policies. It ensures that decisions align with the needs of local communities and ecosystems. Citizens can advocate for stricter enforcement of environmental laws and regulations, deterring industries and individuals from exploiting river resources.

is responsible for divergence amongst other four elements, namely Policies, Programmes, Plans and Projects is "People" because of their wide-ranging professional background and affiliation, commitment to various agencies/ organizations with whom they are engaged than the overarching cause of RRC, and last but not the least very short to relatively long residence time with the agencies/ organization represented by them. Public participation is crucial in river conservation as it fosters a sense of ownership & shared responsibility, enhances sustainability, and promotes effective management of water resources. A sense of ownership & shared responsibility can lead to widespread behavioural changes, such as reducing littering or conserving water at the household level. Further, rivers play a vital role in adapting to climate change by managing floods, storing freshwater, and supporting biodiversity. Public participation ensures the implementation of adaptive strategies, such as riparian buffer zones, which protect against climate-related disasters. In summary, public participation empowers individuals and

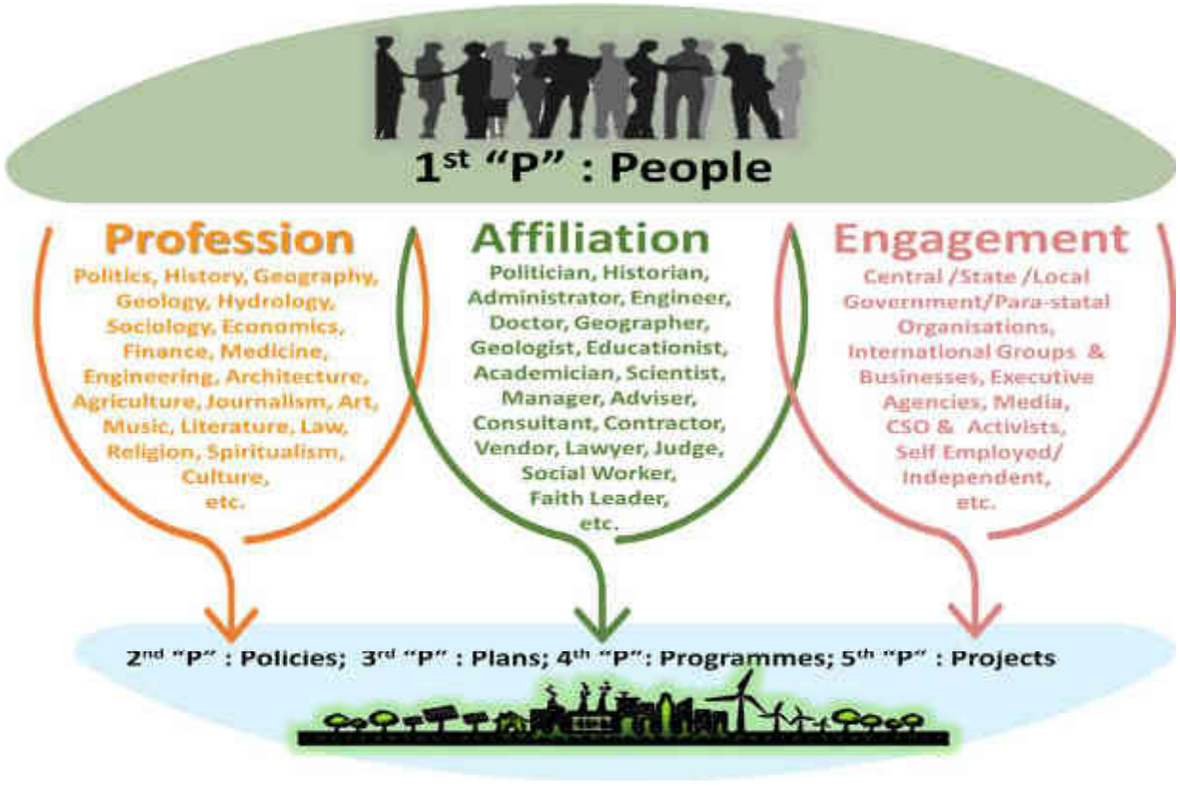

Figure 3: Dominance of People in Understanding Interplay Amongst Five Key Factors (5P's: People, Policies, Plans, Programmes & Projects) for Management of Rivers

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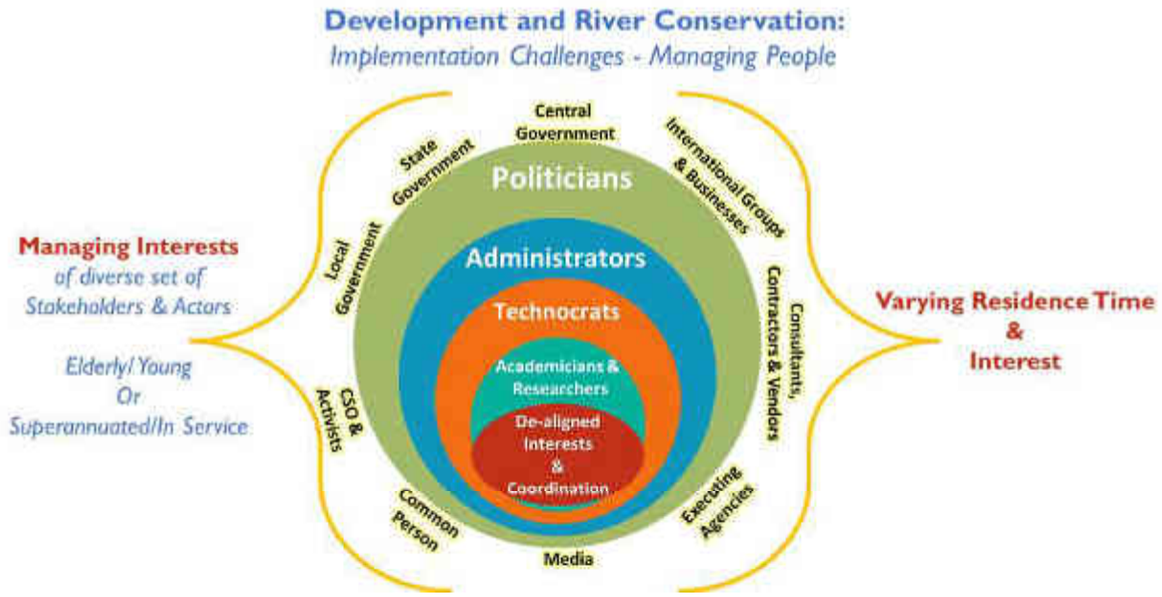

Figure 4: Identification of Implementation Challenge

communities to be active stewards of river ecosystems, ensuring that conservation efforts are inclusive, sustainable, and impactful.

The divergence could best be minimised by actively involving people in endeavors such as over-extraction of water from rivers or dumping of wastes into rivers by disseminating complete information and knowledge of rivers, incentivizing, and consensus-building. On the other hand, creating public awareness, motivating and impressing people through campaigns and by public figures can help in passive involvement of people by voluntarily minimizing water use and avoiding waste dumping in such cases.

While public participation in RRC is very much needed in India, the easiest way to achieve this is obviously through local governance bodies (urban municipalities and gram panchayats) who have the direct access to the masses and by specific public service bodies such as water supply, fishery, and irrigation departments. These agencies, however, may lack extensive river knowledge for meaningfully involving people in RRC. The paucity of river knowledge and lack of initiatives in dissemination of information, incentivizing and consensus-building is perhaps the reason why mainly passive public participation has been achieved by government agencies (often with the help of NGOs/ CSOs and citizens' groups) in India so far. But to carry out RRC successfully and in a time-bound manner both active and passive public participation may be essential.

Public participation also encourages transparency & accountability in river management policies. It ensures that decisions align with the needs of local communities and ecosystems. Citizens can advocate for stricter enforcement of environmental laws and regulations, deterring industries and individuals from exploiting river resources.

Upon completion of the Ganga River Basin Management Plan (GRBMP) by a consortium of 7 IITs in 2015 and as a follow-up action subsequently, it was envisioned to connect with and bring people to the Ganga River. The connection of people is considered crucial in river conservation as it fosters a sense of ownership & shared responsibility, enhances sustainability, and promotes effective management of water resources. Involving communities helps raise awareness about the importance of rivers, their ecological functions, and threats like pollution, overuse, and habitat destruction. As a part of this exercise, the National Mission for Clean Ganga (NMCG) - the nodal agency, embarked upon activities such as to (i) develop/ rejuvenate ghats with basic civic facilities, (ii) re-development/ modernization of existing crematoria, and (iii) river-front development with public facilities including river-view restaurants, etc. These facilities were created/ developed by third-party with active financial support from the NMCG and under guidance of local governments including public representatives. This entire exercise was aimed at bringing people closer to the river. The people will only come closer to the river and its front provided the river is in a healthier state. During the last 8-9 years, the NMCG and local governments have spent resources and energy on the development of ghats, crematoria and riverfronts. However, it is obvious to look back and see: (a) whether the ghats/ crematoria/




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riverfronts have been developed as planned or not? (b) whether there is an incremental increase in footfall over the time to such ghats/ crematoria/ riverfronts or not? (c) Are the ghats attracting people solely due to special rituals? If so, in absence of such rituals, whether footfalls will decrease drastically? (d) whether the riverfronts are being used mainly for religious purposes or otherwise? There are several questions which need answers. These answers are important to undertake formulation of basin management plans of other important rivers.

Considering the above-mentioned aspects, the issues that need to be clarified and resolved for successful river rejuvenation and conservation in India are:

i. How important is public participation for RRC in India?
ii. What type of public participation is needed for RRC in India – passive, active or both?
iii. What methods and approaches should be adopted by government agencies to ensure (a) passive and (b) active public participation? Can some examples from India or abroad be cited to illustrate the proposed solutions?
iv. What actions can be taken by government agencies at different levels (national/ regional/ local) to ensure effective public participation in RRC?
v. What criteria or yardsticks should be used to assess the required degree of public participation in RRC in India and the actual degree achieved?

DISCUSSIONS

This session focused on public participation in river basin management, specifically in the context of river conservation and restoration in India. The discussion revolves around the experiences from the Ganga River Basin Management Plan and how those learnings can be applied to other river basins.

Why Public Participation? Because it fosters ownership, shared responsibility, incorporates local knowledge, promotes sustainable practices, builds partnerships, ensures accountability, encourages behavioural change, enhances climate resilience, and strengthens policy implementation.

KEY PARTICIPANTS AND ROLES:

- **Prof. Mohd Jawed:** Chairs the session, initiates discussions, and provides context, particularly drawing from his experience with the Ganga River Basin Management Plan.
- **Mr. Siddharth Desai:** Presents the background on public participation, its importance, and strategies for enhancing it.
- **Dr. Manoj Tiwari:** Offers insights on the complexities of public participation, emphasizing the need for constructive engagement and defining the scope of participation.
- **Other Participants:** A diverse group including water resource experts, social entrepreneurs, government officials, activists, and individuals working on river conservation, who contribute their perspectives, experiences, and concerns.

CORE THEMES AND DISCUSSION POINTS:

- **Importance of Public Participation:** The central theme is the critical role of public participation in the success of river conservation and restoration efforts. The speakers emphasize that these initiatives are "for the people and by the people".
- **Why Public Participation?** A key question raised is why the public should participate. The responses highlighted that it fosters ownership, shared responsibility, incorporates local knowledge, promotes sustainable practices, builds partnerships, ensures accountability, encourages behavioural change, enhances climate resilience, and strengthens policy implementation.
- **How to Enhance Public Participation:** The discussion explored various strategies, including building awareness and knowledge through educational campaigns and media outreach, making participation convenient and accessible, building sustainable partnerships with NGOs, social sector enterprises, and the private sector, leveraging technology

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and innovation, highlighting success stories, ensuring sustainability of interventions, managing diverse stakeholder interests, engaging marginalized groups, promoting decentralized policy formulation, and tracking participation and engagement.

- **Challenges in Public Participation:** The session acknowledged the challenges in managing the interplay between people, policies, plans, programs, and projects, particularly considering the short residence time of decision-makers and the need to align diverse stakeholder interests.
- **Specific Concerns and Issues:** Participants raised concerns about the effectiveness of existing programs, the lack of coordination between government agencies and grassroots initiatives, pollution control board corruption,





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the need for clearer definitions of river boundaries, and the importance of addressing the socio-economic needs of communities dependent on rivers.

- **Practical Examples and Suggestions:** The discussion includes practical examples from various cities and regions, such as the riverfront development in Patna, river cleanup initiatives in Pune, the Adyar River cleaning in Chennai, and community-based water management in Wayanad. Suggestions are offered to improve public participation, such as increased government support for local initiatives, stricter enforcement of pollution control measures, and leveraging social media to engage younger generations.

The discussion revolved around the vital role of public participation in the success of river restoration and conservation (RRC) initiatives. Participants discuss the 'why' behind engaging the public, emphasizing awareness, ownership, leveraging local knowledge, promoting sustainable practices, building partnerships, and ensuring accountability. The conversation then shifts to the 'how,' exploring methods like educational campaigns, accessible participation avenues, incentives, and building trust with local communities and NGOs. Challenges such as managing diverse stakeholder interests and ensuring the sustainability of engagement are also addressed, along with examples of successful public involvement from cities like Indore and Pune. The session concludes by underscoring the necessity of bridging the gap between citizens and local governing bodies for effective and long-lasting river rejuvenation.

KEY TAKE AWAY POINTS

- Public participation is fundamental for the sustainability and acceptance of river restoration efforts. It fosters awareness, ownership, and shared responsibility.
- Effective engagement leverages local knowledge and promotes sustainable practices at the community level.
- Building trust and strong partnerships between government agencies, NGOs, and the public is crucial for success.
- Understanding the 'why' – what's in it for the public – is essential to motivate participation. Highlighting benefits like improved livelihoods and a healthier environment is key.
- Diverse stakeholder interests need careful management to achieve convergence towards common goals.
- Sustainability of public engagement requires simplified processes, highlighting successes, and empowering local communities.
- Bridging the trust deficit between citizens and local bodies (implementing agencies) is vital, as demonstrated by successful examples like Indore and Surat.
- Learning from past experiences (both successes and failures) and adapting strategies based on local contexts is necessary.
- Public participation should evolve from mere involvement to genuine ownership and initiation of actions.
- While government plays a crucial role, RRC is a collective responsibility requiring active contribution from individuals and communities.

GIST

The core message of this discussion is that public participation is not just desirable but essential for meaningful and sustainable river restoration. The session explored the motivations for public involvement, practical strategies for achieving it, and the obstacles that need to be overcome. Successful case studies highlight the power of citizen engagement and the importance of building trust between the public and implementing agencies. Ultimately, the discussion emphasizes that RRC is a collective responsibility that requires active involvement and a sense of ownership from the people who live alongside and depend on the rivers.

Enablers for River Rejuvenation and Conservation (RRC) IV: Economics & Financing

Day 3:
Friday; December 6, 2024
0930 – 1100 hrs

Chair: **Mr. G Asok Kumar** (IAS Former DG, NMCG & Honorary Senior Fellow, CPR)

Moderator: **Mr. Sanmit Ahuja** (cGanga, IIT Kanpur)

Dr. Manoj Tiwari (IIT Kanpur)

Panelist/ Lead Discussant:
Dr. Pranab Kumar Mohapatra (IIT Gandhinagar)
Dr. Manish Kumar Goyal (IIT Indore)
Dr. Santosh G Thampi (NIT Calicut)
Dr. Jacklin Nilling (NIT Suratkal)
Dr. Minakshee Mahananda (NIT Rourkela)
Mrs. Suvarna Bhat Joshi (HNB Engineers Pvt. Ltd, Noida)
Dr. Uday Kelkar (NJS Engineers India Pvt. Ltd, Pune)
Mr. Siddharth Desai (Kishor Pumps, Pune)
Dr. S P Singh (IIT Roorkee)
Mr. Prabhash Kumar (SMCG, Uttar Pradesh)
Mr. R K Jain (Uttarakhand Peyjal Nigam, Haridwar)
Mrs. Meenakshi Mittal (Uttarakhand Peyjal Nigam, Haridwar)
Dr. Ashwini Mirajkar (NIT, Nagpur)
Dr. Suresh Kumar Thappeta (NIT, Nagpur)
Dr. Sandeep Singh Walia (Dept. of Agriculture & Farmer's Welfare Punjab)

SETTING THE SCENE:

Economics: All ecosystems including rivers provide ecosystem goods and services for human welfare, and sometimes also some disservices. Economic principles are, therefore, central to the valuation of rivers in monetary terms, which in turn can be used to allocate monetary resources for RRC to optimise the benefits for rivers and humans. Environmental economics provides the necessary tools for such economic valuation. The only alternative to rigorous economic valuation is to adopt an ad hoc approach to estimate the economic value of river, but such valuation is subjective and arbitrary. Nevertheless, developing, evolving, and adopting economic processes and instruments are dynamic in nature, and need to be reviewed and discussed periodically.

Financing: Both traditional and innovative interventions for executing RRC need adequate money. Financial allocations are therefore imperative for successful RRC. Where the finances come from, however, is a challenge for RRC. Clearly, to fulfil the goal of Arth Ganga, RRC financing should be at par with the economic value enhancement of rejuvenated/ restored and conserved rivers as determined from the economic valuation of various rivers. Thereafter, central and state governments may directly allocate finances through budgetary allocations, but such allocations may be limited by the financial resources readily available from governments. For example, Capex and Opex spent for carrying out just one of the many activities, and that to partially, to ensure that rivers continue to perform their processes and functions as per the "Samarth Ganga" framework could be much more than the allocations made for such purposes through the Flagship programmes of the government (refer information provided in Figure 5).

The only alternative to rigorous economic valuation is to adopt an ad hoc approach to estimate the economic value of river, but such valuation is subjective and arbitrary. However, developing, evolving, and adopting economic processes and instruments are dynamic in nature, and need to be reviewed and discussed periodically.

Projected CAPITAL Spent

Cost is varying from 1.5 - 2 crores /MLD*

Average is 1.75 crores/MLD*

Projected O & M Spent

Cost is varying from 4 - 6 Rs / m^3 *

Average is 5.8 Rs / m^3 *

Year	Population	Total Sewage Generation	Existing Treatment Capacity	Additional Treatment Capacity	Capital Spending Required	Spending Required Annually on Operations
	(Cr)	(MLD)	(MLD)	(MLD)	(Cr)	(Cr)
2021	48.31	72,368#	36,668	35,700	62,475	15,320
2024	53.04	79,558		42,890	75,058	16,842
2030	60.73	91,101		54,433	95,258	19,286
2040	74.44	1,11,657		74,989	1,31,231	23.638
2050	87.66	1,31,492		94,824	1,65,942	27,837

Population data reference - https://www.worldometers.info/world-population/india-population/

U.N. Dept. of Economic and Social Affairs - Population Division. World Population Prospects: The 2024 Revision. (Medium-fertility variant).

As per CPCB (2021)

* As per data obtained from projects sanctioned by NMCG & NRCD

Figure 5: A Glimpse of Capex and Opex Spent Required to Carry Out One of the Many Activities Partially to Ensure that Rivers Continue to Perform their Processes and Functions as per the "Samarth Ganga" Framework

The questions that need to be resolved for successful economic management and financing of RRC are:

i) How can the economic values of rivers in different states of health be reliably estimated? Can examples be provided of actual economic valuation of rivers in India or the world?

ii) In case rigorous economic valuation of rivers cannot be made, how reliable and approximate are any known methods of their economic valuation?

iii) How can the "polluter pays principle" be applied to stakeholders who damage rivers?

iv) Can the potential benefits of RRC to specific stakeholders be reliably estimated?

v) What possible funding sources can be tapped for RRC and against what guarantees?

Alternative financial sources and mechanisms that consider the direct and indirect benefits of RRC to various sectors/ stakeholders are a definite possibility. Governments may also tap national and international financial institutions and donor agencies to raise funds and low-interest loans for RRC. These, and other possible means of financing, need to be explored for comprehensive financing of RRC activities. But the most reasonable source for raising finances is: (i) from stakeholders who damage rivers – based on the principle equivalent to the "polluter pays principle", and (ii) from potential beneficiaries of RRC if

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their benefits can be assessed reliably.
The questions that need to be resolved for successful economic management and financing of RRC are:

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iii) How can the "polluter pays principle" be applied to stakeholders who damage rivers?
iv) Can the potential benefits of RRC to specific stakeholders be reliably estimated?
v) What possible funding sources can be tapped for RRC and against what guarantees?

DISCUSSION

Salient Points:

1. **Sources of River Pollution:** Rivers are largely polluted by discharge from drains, originating from both organized (sewer networks) and unorganized sources. The challenge lies in building treatment infrastructure for the unorganized segments and deciding between centralized and decentralized systems.
2. **Role of Nature:** Natural water bodies like ponds and lakes are also polluted, but there's no direct economic incentive for customers to pay for their rejuvenation. This cost needs to be factored into the overall upkeep of natural capital.
3. **Quantum of Capital Required:** The investment needed for river rejuvenation is immense. India's average treatment capacity is around 40-45%. The Ganga Basin alone has

Water budgeting at the village level (as mandated in the Jal Jeevan Mission) and water audits are seen as crucial steps for understanding water availability and usage, enabling better resource management and pricing.

a discharge of approximately 15,000 MLD, meaning a significant 7,000-8,000 MLD still needs treatment.

- The CAPEX for STPs is estimated at ₹2-3 crores per MLD, excluding the network costs.
- Pan-India capital investment for treatment capacity is projected to be around ₹1,00,000 crore, with an additional ₹1-1.5 lac crores for the network.

4. **Funding Sources and Water Valuation:** Despite water being a state subject, reliance on central funding persists due to the lack of attributed value to water and subsequent revenue generation.
   - Dr. Manoj Tiwari emphasized the need to treat water as a precious economic good, linking its use to monetary value to change the mindset of wasteful consumption. He suggested exploring marginal cost concepts for the sustainability of treatment projects and advocateed for public participation in financial contributions (e.g., basic charges in Jal Jeevan Mission).
   - Mr. Sanmit Ahuja questioned who ultimately pays for treatment and why states and ULBs largely expect government funding for both CAPEX and OPEX. He highlighted the disconnect between users and the economics of treated water.
   - Mr. Suvarna Bhat Joshi pointed that haphazard urban growth and outdated infrastructure exacerbate the problem. Existing STPs often underperform due to debris and lack of proper sewage networks. She suggested learning from countries like Singapore and Israel and considering private investment, contingent on a viable IRR model.
   - Mr. G Asok Kumar used the example of air (a free resource) versus power (a paid service

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due to infrastructure) to illustrate the difficulty in pricing water, which has historically been taken for granted. He shared his experience with the Hyderabad Metro Water Board, highlighting the political sensitivity of raising water tariffs despite the high costs of supply. He advocated for mandatory water metering as a fundamental first step towards water governance and understanding consumption patterns, noting the high levels of Non-Revenue Water (70-80% in some towns, 50% in Delhi compared to 4-5% in the Netherlands and Denmark). He also mentioned that 20-25% of India's energy is spent on lifting groundwater, of which India is the largest extractor globally (250 BCM annually, exceeding China and USA combined at 240 BCM).

- Mr. Sanmit Ahuja proposed starting with charging commercial and bulk industrial users (hotels, railways, NTPCs, gated communities) who can afford to pay, suggesting a benchmark value for water in different regions. He used the Kushak Nala project in Delhi as an example of a local water market where treated water was sold at ₹40 per cubic meter, with a portion cross subsidizing the upkeep of the natural drain.

5. **Regulation:** The lack of a national water regulator in India is highlighted as a significant issue.
   - Mr. Sanmit Ahuja emphasized that India is the only country without one, unlike the power, gas, telecom, and highway sectors. He questiond the absence of a discussion on the per cubic meter value of water and the

need for a regulator to establish prices that allow for return on investment.

- Mr. Manoj Tiwari supported the need for an independent regulator, drawing parallels with the successful restructuring of the power sector after the introduction of a regulator. He stressed the importance of making the public aware of the true value of water, considering associated health and time costs.
- Mr. Siddharth Desai noted that while Maharashtra has a water regulator (MWRA), it lacks the authority to enforce its tariffs, as implementation rests with local bodies.

6. **Non-Revenue Water (NRW):** High levels of NRW due to leakages and unauthorized use are a major drain on resources and revenue. Bulk metering at distribution points is suggested to identify leakages.
7. **Public Willingness to Pay:** The willingness to pay for water services is linked to the reliability of the supply. Creating successful models of consistent supply can increase public acceptance of water charges.
8. **Corporate Social Responsibility (CSR):** While CSR can play a role in awareness and capacity building, it's argued that relying on it for national infrastructure development is not sustainable.
9. **Incentivizing Water Saving:** Green credits are proposed as a mechanism to incentivize industries and other users to conserve and recycle water.
10. **Polluter Pays Principle:** The "polluter pays" principle is discussed, but its effective implementation is challenging due to issues

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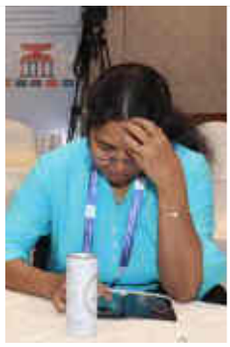


like outsourcing of polluting activities and weak enforcement.

11. **Nature Valuation:** The session touches upon the need to value nature and incorporate the cost of rejuvenating natural water bodies into water pricing mechanisms.
12. **Water Budgeting:** Water budgeting at the village level (as mandated in the Jal Jeevan Mission) and water audits are seen as crucial steps for understanding water availability and usage, enabling better resource management and pricing.

Time to expeditiously and seriously ponder over:

- Who is ultimately responsible for paying for river rejuvenation and the treatment of polluted water?
- Is it too late to build sewer networks in older cities? Should decentralized systems be prioritized?
- Isn't it time for India to have a national water regulator?
- How can the true value of water be established and communicated to the public?
- How can the high levels of Non-Revenue Water be reduced?
- How can private investment be attracted to the water sector?
- How can water saving be incentivized?
- How can the "polluter pays" principle be effectively implemented?
- How can the cost of nature rejuvenation be factored into water financing?

The session concluded with a general consensus that there is a need to move towards a regulatory framework for the water sector and to establish a value for water that reflects its true economic and environmental costs, ultimately leading to more sustainable financing mechanisms for river rejuvenation.

GIST

Financing river rejuvenation in India is a monumental challenge due to the sheer scale of pollution, the enormous capital investment needed for treatment infrastructure, and the lack of a robust economic valuation and regulatory framework for water. The session grapples with questions of responsibility for payment, the feasibility of infrastructure development, and the urgent need for a national water regulator to establish the value of water, attract investment, and ensure the financial sustainability of river cleanup efforts. The discussion highlights the complexities of water pricing in a politically sensitive environment and explores potential models for cost recovery and valuing natural water bodies.

KEY TAKE AWAY POINTS

- **Massive Funding Gap:** Rejuvenating India's rivers requires a staggering amount of capital for treatment plants and sewer networks, far exceeding current investment.
- **Water's Economic Value:** The prevailing mindset of water as a free resource needs to change; it must be treated as an economic good to ensure financial sustainability of rejuvenation projects.
- **Who Pays?** The question of who is responsible for funding treatment (centre, states, users) remains a key challenge, with a reluctance from ULBs to burden users.
- **Need for a National Water Regulator:** India is unique in lacking a national water regulator to establish the value and pricing of water, hindering investment and sustainable financing models.
- **Complexities of Water Pricing:** Politically sensitive water pricing, subsidies, and non-revenue water (NRW) contribute to the financial unsustainability of water management.
- **Potential of Private Investment:** Private sector involvement could bring much needed capital but requires a clear regulatory framework and viable return on investment.
- **Valuing Nature:** The economic value of natural water bodies and their upkeep needs to be integrated into water pricing models.
- **Importance of Metering:** Accurate metering of water usage is a fundamental first step towards establishing accountability, pricing, and managing NRW.
- **Learning from Success Stories:** Examples like Phnom Penh demonstrate that even in poor areas, reliable water supply with reasonable charges can be accepted if the benefits are clear.
- **Targeted Pricing:** Differentiated pricing for commercial, industrial, and domestic users, along with addressing high-end consumers and bulk users, could be a starting point for revenue generation.

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Quantum and Efficacy of Essentials & Convergence Efforts for River Rejuvenation and Conservation (RRC)

Day 3:
Friday; December 6, 2024
1130 – 1300 hrs

Chair: **Mr. G Asok Kumar**
(IAS Former DG, NMCG & Honorary Senior Fellow, CPR)

Moderator: **Dr. Mohammad Jawed** (IIT Guwahati)
Mr. Siddharth Desai (Kishor Pumps, Pune)
Dr. Manoj Tiwari (IIT Kanpur)

Panelist/ Lead Discussant:
Dr. Pranab Kumar Mohapatra (IIT Gandhinagar)
Dr. N V Umamahesh (NIT Warangal)
Dr. Athira P (IIT Palakkad)
Dr. Santosh G Thampi (NIT Calicut)
Dr. S P Singh (IIT Roorkee)
Mr. Prabhash Kumar (SMCG, UP)
Mr. R K Jain (Uttarakhand Peyjal Nigam, Haridwar)
Dr. Ashwini Mirajkar (NIT Nagpur)
Dr. Suresh Kumar Thappeta (NIT Nagpur)
Mr. Amit Kumar (SMCG, Jharkhand)

SETTING THE SCENE

The past many decades of anthropocentric activities reveal that humans have tremendous potential to adversely impact river-systems, while the long-term sustenance of activities/ projects, which are directly or indirectly influenced by and/or impacted by river systems, is much dependent on the existence of healthy rivers. Thus, it is imperative that human-river interaction is understood and managed in a holistic manner adopting the "Samarth Ganga" framework to achieve Sustainable Development Goals (SDGs).

Experience of managing large river basins with focus on ensuring sustenance of rivers reveals that the state of the health of large rivers (higher order rivers) is much dependent on the condition of tributaries, smaller rivers (lower order rivers; commonly referred to as rivulets, streams or drains). Many factors, particularly influencing the health of the rivers and having interplay amongst themselves, need to be identified, studied and managed to attain the overarching goal of "Samarth Ganga" in restoration and conservation of small rivers in larger river basins like Brahmaputra, Ganga, Mahanadi, Narmada, Godavari, Krishna, Cauvery, etc. Such factors could be broadly viewed as consisting of Five Elements or Five P's, namely, People, Policies, Plans, Programmes and Projects. The single most important challenge in River Basin Management is bringing convergence amongst these Five Elements (refer Figure 6).

Thus, the thrust of deliberations in the Seventh Edition of India Water Impact Summit (7th IWIS) was to understand, elaborate, delineate potential causes of divergence, and formulate strategy for convergence through collation of views expressed in Plenary Sessions, Panel

Multiple river-related programmes carried out by national and state governments and their subordinate institutions may often overlap or intersect insofar as they affect rivers. The lack of synergy in such cases calls for a continuous or periodic assessment of the bottlenecks in their coordination and the means to overcome them through a convergence in policies and practices of different river-related programmes.

Discussions, International Forums, and informal discussions through intense engagement with the most influential players.

Multiple river-related programmes carried out by national and state governments and their subordinate institutions may often overlap or intersect insofar as they affect rivers. The lack of synergy in such cases calls for a continuous or periodic assessment of the bottlenecks in their coordination and the means to overcome them through a convergence in policies and practices of different river-related programmes. Co-involvement of programme implementation agencies, independent experts, knowledge bodies, and community and people's representatives in such assessments are essential along with independent third-party monitoring.

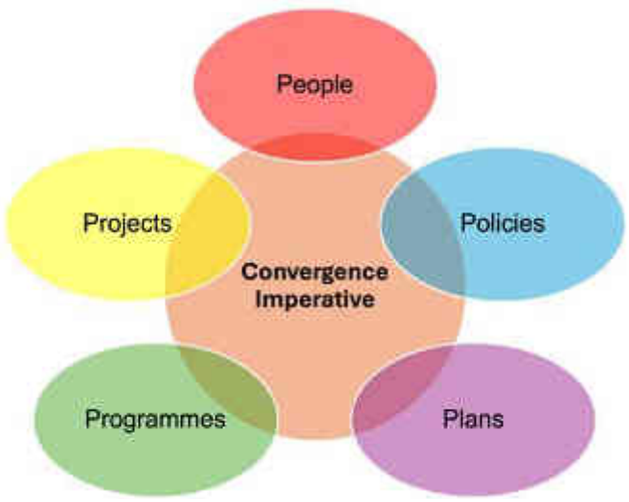


Figure 6: Convergence Amongst 5 P's as the Most Significant Challenge in RRC

While many aspects are at play, a select few that are key to initiate and monitor the progress of river restoration programmes include (i) setting the goal to determine healthy status of the river, (ii) establishing norms for bio-physical status of rivers, determining the present condition in different stretches starting from origin to destination, (iii) formulation and execution of river monitoring programmes, (iv) information/ data collation, utilisation and dissemination strategy, (v) setting mile stones and assessment of river restoration/cleaning programme(s), and (vi) circular economy, finance, policy and governance aspects of water, sewage, sludge and solid waste management.

In the past 10 years many mega initiatives such as Swachh Bharat Mission, Namami Gange Programme, Jal Jeevan Mission, Atal Bhujal Yojana, Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Digital India, etc. that directly or indirectly relate to restoration and conservation of river systems were launched. Similar initiatives are also taken by many state governments to restore and conserve river systems including efforts through MGNREGA. It is essential that various activities carried out by multiple agencies of central, state and local governments as well as of international groups are scanned through the lens of a larger vision of river restoration and conservation to feed into the UN SDGs. It is imperative to understand the bottlenecks in bringing convergence of actions on ground through many projects formulated via various sectorial programmes to achieve the vision of "Samarth Ganga".

Large rivers, being major sources of various river services, are often in the limelight, but small rivers seldom receive the same degree of attention for

Quantum and Efficacy of Essentials & Convergence Efforts for River Rejuvenation and Conservation (RRC)

restoration and conservation. Yet, small rivers and streams that merge with large rivers directly or via higher-order rivers, are vital components of the larger rivers themselves. Hence their revitalization and conservation are crucial for the entire river network. Given their relatively small scales, the conservation of small rivers may not require large-scale multi-institutional involvement but may be efficiently carried out with the active involvement of local governance bodies, communities and people.

Numerous river-related programmes are carried out by national and state governments which may be prima facie designed with other goals such as infrastructure (roads, bridges, power plants, etc.) and social development (water supply, sanitation, housing, healthcare, rural environment, etc.), but they have significant impacts on river systems. Hence, along with programmes that are directly related to rivers – such as inland navigation, surface irrigation, fisheries, hydropower, etc. – they all affect our rivers in multiple ways. A comprehensive review of such impacts can provide valuable lessons in how to minimize river stresses and ensure synchronicity of development with river conservation (refer Figure 7).

Numerous river-related programmes are carried out by national and state governments which may be prima facie designed with other goals such as infrastructure (roads, bridges, power plants, etc.) and social development (water supply, sanitation, housing, healthcare, rural environment, etc.), but they have significant impacts on river systems. A comprehensive review of such impacts can provide valuable lessons in how to minimize river stresses and ensure synchronicity of development with river conservation.

Generally, plans for conservation and restoration of rivers are made at the central level with active participation of stakeholders such as central/state/local governments, religious institutions, non-governmental organisations, academia, scientists/technologists, and other important public figures. Once the plans are accepted at the highest level, then the same is forwarded for implementation to states/local governments as they have agencies on the ground to give a definite shape to the conservation and restoration plan on the ground in their respective area of operation. Hence, it is important to not only have a strong political will at the apex level, but the same must percolate down the line up to the local government via the concerned state governments. In a federal structure of governance - as is the case with our governance, lack of convergence at any level shall have serious impact on plans of such importance such as conservation and restoration of river systems across the width and breadth of our country. As considerable efforts have been directed by various stakeholders in the past for the conservation and restoration of the river Ganga, hence it is time to revisit the same with an open mind to understand the following: (a) what are the essentials of implementing river conservation and restoration plans while keeping interests of multiple - stakeholder intact, and (b) whether the level of political will was same at all levels while implementing the conservation and restoration plans.

This particular session, therefore, would like to focus on the following points:

i. Current status of the essential elements under the Samarth Ganga framework for river conservation and restoration
ii. What is quantum and efficacy of such essential elements in ongoing measures in respect of conservation and restoration of river Ganga?
iii. How to develop connection between essentials and multi-stakeholder convergence?
iv. If river basin management plans have to be formulated for other basins in future, what essentials have to be considered and to what extent?
v. What measures are required to ensure convergence at all levels of decision making and carrying out effective implementation activities in respect of river conservation and restoration?

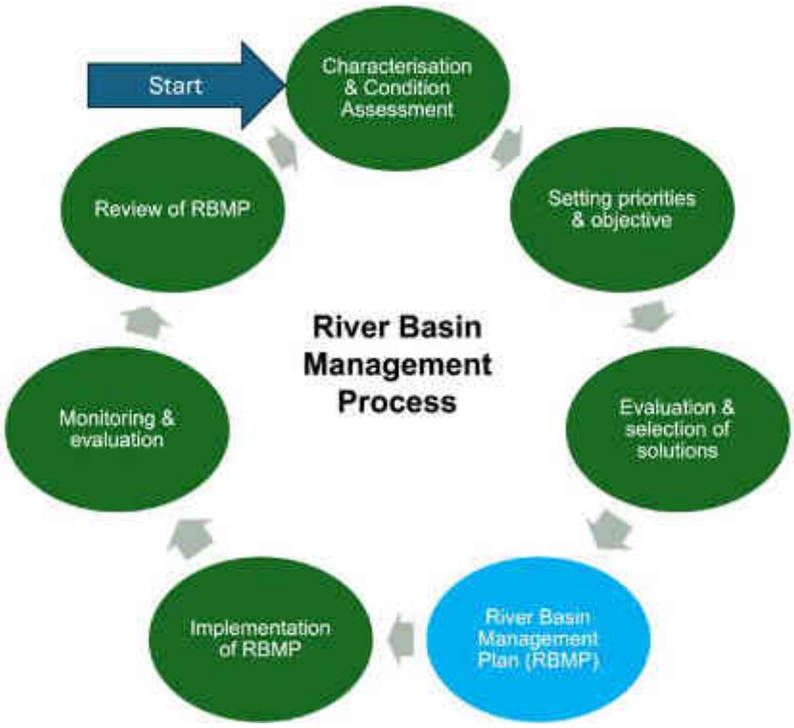


Figure 7: Following River Basin Management Plan Cycle Through Cycles of Various River Related Programmes

Quantum and Efficacy of Essentials & Convergence Efforts for River Rejuvenation and Conservation (RRC)

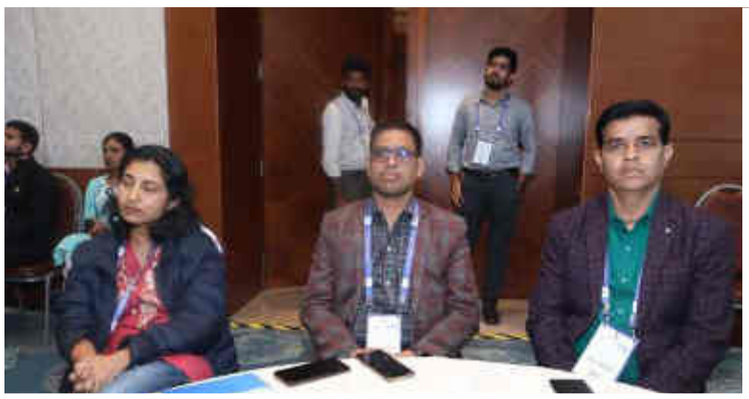
vi. If there is a lack of information on essentials and convergence aspects from the previous plan such as GRBMP, then is it necessary to obtain the missing information at the earliest before moving ahead for consideration of new river basin management plans?

DISCUSSION

This session extensively delved into the critical challenges and potential solutions for effective river conservation and restoration, particularly within the context of the Ganga River Basin Management Plan (GRBMP) and the newly initiated Condition Assessment and Management Plan (CAMP) studies for six other Indian river basins. The discussion highlights the complexities of achieving convergence among diverse stakeholders and the necessity for robust monitoring and evaluation mechanisms. Here's a detailed breakdown of the key themes and points raised:

1. Reviewing GRBMP - 2015 and the Challenge of Convergence:

- The initial focus is on evaluating the efficacy measures of GRBMP - 2015.
- A central challenge identified is achieving convergence between different means to reach the overarching objective of river conservation and restoration.
- The discussion emphasizes a brief review of the Samartha Ganga framework (mentioned by Dr. Tare) before delving into the essentials of implementing river conservation and restoration plans.






2. Essentials for Implementing River Conservation and Restoration Plans (Identified by the Samarth Ganga Framework):

- **Political Will:** The necessity of strong political will, especially regarding marginal cost and pricing mechanisms for water cost recovery. The current public spending (20,000 crore over five years) is acknowledged, but the need for more substantial investment is highlighted.
- **Public Spending:** Exploring ways to increase public spending beyond the committed amount.
- **Partnerships:** Leveraging the trust established by local NGOs and social enterprises within communities to facilitate the implementation of river basin management plans.
- **Public Participation:** Ensuring meaningful engagement of the public in conservation efforts.
- **Sustenance and Perseverance:** Strategies to ensure the long-term viability and continuation of conservation efforts.
- **Measurement of Success:** Identifying yardsticks to assess the effectiveness of these essentials. Examples include the return of dolphins and the resurgence of social activities (like marriages) on riverbanks as positive feedback loops indicating economic activity.

3. Measuring the Efficiency of Essentials and the Importance of a Program Cycle:

- The lack of a defined program cycle for reviewing management plans is identified as a weakness.
- A program cycle is defined as a structured process encompassing planning, implementation, monitoring, and evaluation.
- Key benefits of a program cycle include:
  - **Efficiency:** Optimal use of public resources.
  - **Transparency:** Accountability in spending.
  - **Effectiveness:** Incorporation of measures that yield results.
  - **Adaptability:** Allowing for adjustments and improvements based on monitoring and evaluation.
- Dr. Tare emphasized the need to strengthen monitoring and evaluation.
- The discussion touches upon monitoring, supervision, evaluation, and reporting accountability as crucial aspects for GRBMP 2.0.

4. Monitoring, Supervision, Evaluation, and Reporting Accountability (GRBMP 2.0 Focus):

- Developing Key Performance Indicators (KPIs) and frameworks for monitoring.

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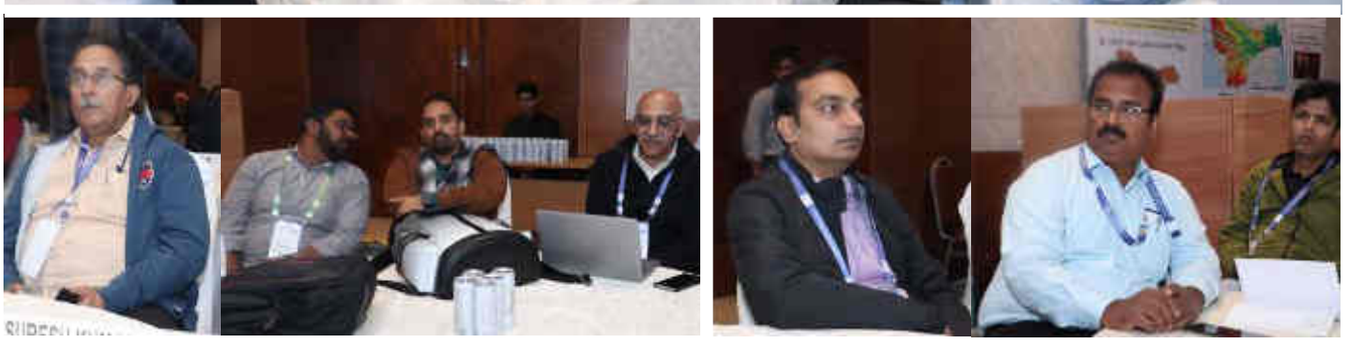
- Utilizing real-time data collection (e.g., dashboards at NMCG monitoring STPs via CCTV).
- Establishing mechanisms to resolve implementation challenges and bottlenecks.
- Engaging independent third-party audits within the existing statutory and structural framework of NMCG.
- Conducting midterm and end-term evaluations, comparing outcomes against benchmarks, and identifying gaps and lessons learned.
- Redesigning schemes based on feedback.
- Publishing reports on expenditures, providing regular updates to government bodies, and responding to stakeholder feedback.
- The central theme is establishing an automatic feedback mechanism, potentially by engaging local NGOs and social sector enterprises.

5. Means of Implementation (The Five Ps):

- Identifying "People, Policies, Plans, Programs, and Projects" as the means of implementation.



- The core challenge is achieving convergence between these five aspects.
- The discussion aims to understand the potential causes of divergence and formulate strategies to move towards convergence.

6. Achieving Convergence: A Multi-Stakeholder Approach:

- Convergence requires a coordinated multi-stakeholder approach, which NRCD has initiated under the CAMP for six other river basins.
- The CAMP aims to develop integrated river basin management plans for the wholesomeness of these rivers, incorporating monitoring and evaluation as key components.

7. Key Strategies for Achieving Convergence:

- **Managing Diverse Interests:** Bridging the gaps between different government institutes, private enterprises, local bodies, and community interests.
- **Establishing a Unified Vision and Goal:** Working towards an agreement on shared objectives to create a collaborative framework (multi-stakeholder agreements).
- **Stakeholder Engagement:** Actively involving various stakeholders (as highlighted by CAMP).
- **Policy Advocacy and Program Harmonization:** Moving towards sustainable water pricing mechanisms and harmonizing policies across different government levels to avoid divergences.
- **Centralizing Databases and Data Sharing:** Utilizing centralized data (like NMCG's) for effective management and creating convergence.
- **Integrated Plans and Resource Planning:** Developing cohesive plans and strategies for resource management.
- **Joint Monitoring:** Enhancing collaborative monitoring efforts.
- **Community-Centric Approach:** Defining the contours of public participation to effectively gather feedback.
- **Coherent Financing Mechanisms:** Exploring financing strategies that promote convergence.
- **Adaptive and Participative Governance:** Promoting participatory decision-making in river basin authorities (drawing lessons from the National Water Mission's work on participatory groundwater management).
- **Continuous Monitoring and Evaluation:** Emphasizing the need for robust third-party independent monitoring mechanisms within the existing legal framework.

8. Points of Divergence vs. Convergence (Perspective of Mr. G. Asok Kumar, Former, DG, NMCG):

- Shifting the focus from identifying divergences to identifying points of convergence.
- Convergence requires bringing everyone

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together on a common platform with a clear, unified objective (e.g., the return of native species).

- Highlighting how policies unrelated to water (e.g., free power for farmers, delayed crop sowing) can significantly impact the water sector, underscoring the importance of a "whole of government" approach.
- Emphasizing that convergence is crucial but challenging, especially in the water sector where various aspects are handled by different departments.
- Stressing the need to involve all stakeholders, including children and future generations.
- Acknowledging the presence of political will in some areas but its absence in others (e.g., water pricing).
- Advocating for enabling political will and increased private sector participation.
- Highlighting the importance of perseverance to see the results of conservation efforts.

9. The Need for Transforming Ideas into Action (Perspective of Dr. Manoj Tiwari, cGanga, IIT Kanpur):

- Emphasizing that agreements and discussions on convergence are useless unless they are translated into tangible actions on the ground.
- Focusing the discussion on the best ways to facilitate convergence for implementation purposes.

10. Complexity and Variability of the Issue (Perspective of Dr. Mohd Jawed, IIT Guwahati):

- Highlighting the complexity and challenging nature of river water issues.
- Emphasizing that essentials and means of implementation can vary significantly across different stretches of a river and between different river basins.
- Sharing Professor G.D. Agrawal's observation about the difficulty of convergence even among knowledgeable individuals (like IIT faculty) and the increased complexity when government organizations, NGOs, and the public are involved.
- Suggesting prioritizing convergence on key essentials and focusing on their implementation.
- Clarifying that the Prime Minister's office monitors the progress, not solely NRCD.
- Stressing the need for hard work and collaboration to achieve success and uphold the reputation of implementing agencies.

11. Decentralized Convergence and the Role of NARI and SARI (Perspective of Mr. G. Asok Kumar, Former, DG, NMCG):

- Highlighting the ongoing decentralized convergence with the involvement of multiple IITs and NITs across the country.
- Introducing the concept of NARI (National Authority of Rivers in India) as an umbrella organization for all rivers, with Ganga as a part of it.
- Proposing SARI (State Authority of Rivers) to facilitate convergence at the state level among departments related to water pollution.
- Emphasizing that solutions need to be context-specific to different rivers and regions.

12. Institutionalizing Convergence and Addressing Policy Contradictions (Perspective of Mr. Siddharth Desai, Kishor Pumps, Pune):

- Questioning how to institutionalize the mechanism for achieving convergence, linking it to the NARI and SARI concept.

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- Raising the issue of policy contradictions (e.g., the Subsoil Water Act in Punjab/ Haryana leading to smog in Delhi, the power tariff policy affecting agricultural irrigation).
- Seeking opinions on how to achieve policy harmonization through structured feedback mechanisms at both central and state levels.

13. District Level Convergence and Local Initiatives (Perspective of Mr. Nitin Kaushal, WWF-India):

- Highlighting the role of the District Ganga Committee (DGC) as a key mechanism for convergence at the district level.
- Providing examples of successful local initiatives involving wetland conservation and irrigation water use efficiency achieved through collaboration between NGOs, district administration, irrigation departments, and farmers, often utilizing funds from schemes like MGNREGA.
- Emphasizing the importance of the DGC in facilitating these collaborations.

14. Empowering District Ganga Committees (Perspective of DPO Lalitpur):

- Highlighting the issue of policies and frameworks diverging as they move from the top down, hindering the effectiveness of DGCs.
- Advocating for empowering DGCs with independence in their work, reporting, and coordination with other departments.
- Stating that DGCs are often held responsible at the ground level but lack the necessary empowerment and resources.
- Requesting empowerment to provide accurate ground-level data for policy formulation.

15. Water as a Central Fulcrum (Perspective of Mr. Mithilesh Mishra):

- Expressing the need for water to become a central focus ("daughter of water") in everyone's mind and actions, similar to the reverence for "mother earth" and "son of soil."
- Highlighting the absence of "water" in the traditional saying "माँ मानुष और माटी" (mother, human, and soil), suggesting a need to elevate its importance.

16. Progress and Impactful Initiatives (Perspective of an un-identified participant):

- Sharing experiences from implementing projects under Namami Gange, noting the social and political changes and significant momentum.
- Highlighting positive initiatives like planting medicinal plants and utilizing solar power at water treatment plants and STPs, acknowledging NMCG's support.
- Providing an example of rapid problem-solving and support from NMCG in facilitating the switch to solar power.

17. Ground Level Challenges and Needs (Perspective of an un-identified participant):

- Emphasizing the need for efficient, calibrated, empowered, stable, equipped, and pressure-free structures at the ground level for effective implementation.

- Highlighting the dire lack of resources at the DGC level, even for necessities like paper.
- Requesting training and regular guidance from higher authorities for DGCs.
- Pointing out coordination issues with other departments like the Forest Department, which often operates independently.
- Noting a lack of awareness among some departments regarding the functions and importance of DGCs.

18. The Importance of Public Awareness and Behavioural Change (Perspective of Dr. Mohd Jawed, IIT Guwahati & Mr. Hemant Yadav):

- Using an anecdote about students' perception of river water pollution to highlight the need to sanitize people's understanding and promote awareness.
- Emphasizing that water is becoming "physically invisible" in people's daily fparu (thought process) unless it directly affects their immediate needs.
- Stressing the need to reach the common person and instil a sense of responsibility towards water conservation.
- Illustrating how seemingly small behavioural changes (like using plastic bags) can contribute to larger environmental problems.
- Sharing observations from Sikkim where strong community adherence to government notices and environmental norms exists, suggesting the importance of a supportive system and consistent reinforcement.
- Highlighting the negative impact of unplanned infrastructure development (e.g., raising road heights) on ecosystems and local communities.
- Pointing out unsustainable practices like excessive bleaching powder use during VIP visits and unmanaged construction during festivals.
- Suggesting learning from examples like Bangkok's flexible infrastructure management.
- Advocating for system-based approaches to induce behavioural change, drawing parallels with Singapore's successful water

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management practices through education, especially targeting children.
- Suggesting the widespread installation of pollution monitoring instruments to raise public awareness.

19. System-Based Scalability and Long-Term Impacts (Perspective of Dr. Mohd Jawed, IIT Guwahati & Mr. Siddharth Desai, cGanga, IIT Kanpur):

- Emphasizing the need for system-based scalability of successful convergence models.
- Highlighting the importance of infusing environmental consciousness in young people as they will be the future custodians of the system.
- Questioning the focus solely on "green" initiatives without adequately addressing the "blue" (water) aspects, particularly concerning the encroachment on water bodies.
- Advocating for a multi-model policy formulation approach that considers the long-term impacts of decisions, citing the Harit Kranti as an example of short-sighted policies with long-term negative consequences for water bodies.

20. Third-Party Audits and Yardsticks for Success (Perspective of Mr. G. Asok Kumar, Former, DG, NMCG):

- Suggesting that the return of native species and public support are the best forms of third-party audits, as they are unbiased indicators of the effectiveness of conservation efforts.

21. Local Conservation Efforts and Community Involvement (Perspective of an un-identified participant):

- Sharing a successful example of community-led river rejuvenation efforts in Bihar involving

planting native and medicinal plants along riverbanks to purify water, enhance oxygen levels, and attract rainfall.

22. Summarizing key suggestions for achieving convergence (Perspective of Mr. Siddharth Desai, cGanga, IIT Kanpur and Dr. Mohd Jawed, IIT Guwahati):

- Incorporating medicinal plant planting in the CAMP project.
- Defining effective communication methods for common objectives.
- Harmonizing or removing policy contradictions through focused groups.
- Balancing budgets for the water sector in climate discussions.
- Further exploring the NARI and SARI concepts.
- Empowering District Ganga Committees and Jal Shakti Kendras.
- Promoting cross-program convergence (e.g., DGCs and MGNREGA).
- Implementing targeted communication strategies for behavioural change (e.g., focusing on children).
- Developing system-based scalable solutions.
- Using the return of native species as a key yardstick for success.
- Acknowledging the positive and engaging nature of the discussion, indicating the relevance of the topic and the active participation of attendees.
- Expressing the intention to incorporate the valuable contributions into the CAMP project and provide feedback on progress in future discussions.

In essence, the above perspectives reveal the multifaceted challenges of river conservation and restoration, emphasizing the critical need for convergence across various stakeholders, policies, and implementation mechanisms. It highlights the importance of strong political will at all levels (centre, state, local governments), effective governance structures (like creating middle administration (headed by Divisional Commissioner) level bodies for knowledge creation and dissemination, planning, monitoring and feedback), empowered DGCs for effective implementation), community engagement, behavioural change, robust monitoring and evaluation, and a holistic, long-term perspective in achieving the goal of healthy and vibrant rivers. The discussion around NARI and SARI suggests a potential institutional framework for fostering this convergence at the national and state levels.

GIST

This session focused on reviewing the effectiveness of the Ganga River Basin Management Plan (GRBMP) - 2015, particularly concerning public participation, and identifying ways to achieve convergence among various implementation means. The discussion highlighted the importance of a well-defined program cycle for efficient resource use, transparency, and adaptability.
It emphasized the need for a multi-stakeholder approach to achieve convergence, addressing diverse interests and ensuring policy coherence. The session explored the challenges of balancing state autonomy with national priorities and emphasizes the need for a structured mechanism to harmonize policies and facilitate data sharing. The discussion also touches upon the importance of public involvement, the need for a clear definition of objectives and framework, and the role of academic institutions and government collaboration.

KEY TAKE AWAY POINTS

- **Importance of a Program Cycle:** A well-defined program cycle is crucial for efficient resource use, transparency, and adaptability in river basin management.
- **Need for Convergence:** Achieving convergence among diverse stakeholders (government agencies, NGOs, communities) and policies is essential for effective implementation.
- **Multi-Stakeholder Approach:** A coordinated, multi-stakeholder approach is required to address the complex challenges of river conservation and restoration.
- **Unified Vision and Goals:** Establishing a shared vision and objectives is fundamental for achieving convergence and collaboration.
- **Policy Harmonization:** Harmonizing policies across different government levels and sectors is necessary to avoid contradictions and ensure coherence.
- **Data Sharing and Integration:** Centralizing databases and facilitating data sharing among stakeholders is crucial for informed decision-making.
- **Community-Centric Approach:** Engaging local communities and incorporating their input is essential for successful and sustainable river management.
- **Independent Monitoring and Evaluation:** Establishing independent monitoring and evaluation mechanisms is needed to assess the effectiveness of interventions and ensure accountability.
- **Addressing Policy Contradictions:** Identifying and resolving policy contradictions and overlaps is crucial for effective river basin management.
- **Structured Mechanisms for Feedback:** Implementing structured feedback mechanisms is essential for continuous improvement and adaptation of river management plans.

CURRENT CHALLENGES

TRACK B - IWIS | SESSION B1

December 04 - 06, 2024

Environmental Flows – Implementation Challenges

Day 2:
Thursday; December 5, 2024
0930 – 1100 hrs

Moderator: **Mr. Anup Kumar Srivastava** (Executive Director (Technical), NMCG
Dr. P Bose (Professor, IIT Kanpur)

Key Speakers:
Mr. Suresh Babu (Director River Basins & Water Policy, WWF-India)
Ms. Laura Sustersic (Project Director, GIZ)
Mr. D P Mathuria (Chief Engineer, CWC)

Panelist/ Lead Discussant:
Dr. Anurag Ohri (IIT BHU)
Dr. Minakshee Mahananda (NIT Rourkela)
Mr. Nitin Kaushal (WWF India, New Delhi)
Mr. Arjit Mishra (WWF India, New Delhi)
Dr. R L Narendran (Tamil Nadu Pollution Control Board)
Mr. A Rajaram (Tamil Nadu Pollution Control Board)
Mr. Avtar Singh (Punjab Pollution Control Board)
Mr. Jaspal Singh (Punjab Pollution Control Board)
Dr. Sanjay Kumar Singh (Rajasthan State Pollution Control Board)
Mr. Sumit Sharma (Rajasthan State Pollution Control Board)
Mr. Bipin Singh (SMCG, Uttar Pradesh)
Mr. Roopesh G. Krishnan (Central Ground Water Board, Kerala)
Dr. Aneesh Kumar V (Central Ground Water Board, Kerala)
Dr. Vimal Mishra (IIT Ghandhinagar)
Mr. Amit Kumar (Uttarakhand Jal Sansthan, Mussoorie)
Mr. Shailesh Kumar Yadav (UP Jal Nigam, Mau)
Dr. Ambili G K (CWRDM, Kerala)
Mr. Gurlal Singh (WRD Punjab)
Dr. Sudarshan S Pagar (WRD, Nashik)
Mr. M Naveen Goud (MRDCL, Hyderabad)
Mr. G Varun Kumar (MRDCL, Hyderabad)

SETTING THE SCENE

Maintaining environmental flows, or E-flows, in rivers is acknowledged worldwide as a basic need for any healthy river, and the same has been emphasized repeatedly by Indian river scientists and advocates of river conservation. It was also strongly recommended by GRBMP–2015 and cGanga for perennial rivers in India. To this day, however, adoption of E-flows has been extremely rare in India. In fact, in-principle acceptance of E-Flows for rivers have not yet been notified by the government, suggesting that the government may be still undecided about E-flows for rivers in general. But there could be significant gains in implementing E-flows in the medium and long terms for sustainable development and river conservation. So why is implementation of E-Flows virtually non-existent in India? Are there challenges for stakeholders' committment for implementing E-Flows? Or are there institutional, technical, and policy challenges in implementing E-Flows in India? These and other/ related issues need to be examined to ensure early implementation of E-Flows for perennial Indian rivers.

DISCUSSION

This session provided a comprehensive overview of the status, persistent challenges, and potential pathways forward for the implementation of Environmental Flows (E-flows) in India's diverse river systems. Mr. Anup Shrivastava initiated the discussion by acknowledging the success in notifying and monitoring E-flows in the Ganga Basin (Gomukh to Unnao) across 11 barrages. However, he emphasized the significant challenge of extending similar notifications to other river systems, citing pending implementation despite studies (e.g., Yamuna) and ongoing planning for E-flow assessments in other basins (Chambal, Betwa, Tons, Gandak tributaries).

Mr. Suresh Babu elaborates on the evolution of E-flows in India, from an initial focus on minimum flows to the Ganga E-flows notification and ongoing initiatives like the CAMP project aiming to address E-flows in six new river basins. He stresses that the definition and algorithm for assessment are well developed from extensive studies and reporting by cGanga and WWF-India and need to be notified by the Central Government. However, methodologies must be context-specific, tailored to the unique ecosystem, geography, and stakeholders of each river. The core requirement is freshwater flows of the right quantity, timing, and quality to sustain river functions and services. A crucial point is that E-flow implementation transcends

water resources, requiring the active involvement of other key stakeholders. Mr. Babu highlights the need to address trade-offs in water allocation, particularly in over-allocated basins, and build negotiation capacity. He also emphasizes the importance of moving beyond flow assessments to actively bringing water back into rivers, connecting various influencing factors. The Ramganga basin experience demonstrates the positive ecological response to enhanced flow regimes, even if below recommended levels. Engaging water managers early in the discussion is vital, with technical institutions supporting and monitoring the impacts. The potential of wetland rejuvenation and groundwater contribution to base flows, as seen in the Aril river case, offers alternative strategies beyond dam releases. Furthermore, leveraging agricultural water use efficiency presents a significant opportunity to free up water for E-flows, as demonstrated by pilot projects involving farmers. The need for institutional mechanisms at the river basin level to coordinate these efforts across administrative boundaries is also highlighted.

Ms. Laura from GIZ provided an international perspective, drawing parallels with the European Water Framework Directive, which mandates ecological flows and water permits. The EU's experience in river renaturation after significant alteration underscores the long-term commitment required. She reinforces the three key components of E-flows: quantity, timing, and quality, all impacted

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by built environments. While acknowledging the challenges of enforcement, the EU's system of water permits, where allocations consider environmental needs, offers a potential learning point. Ms. Laura concurs that a common definition and algorithm for assessment are well developed from extensive studies and reporting by cGanga, WWF-India, GIZ and need to be notified by the Central Government. She also emphasized context-specific methodologies and advocates for a cyclic, adaptive approach to E-flows implementation, starting with feasible measures and reassessing impacts over time.

Mr. D P Mathuria from the Central Water Commission presents the ground reality and implementation hurdles. He cites a Supreme Court case highlighting the debate over adequate E-flows percentages and the CWC's assessment that E-flows implementation is lacking on the ground. He emphasizes the fundamental need for notifying a clear definition and algorithm for E-flows assessment and the importance of recognizing rivers' ecosystem services to justify their maintenance. Convincing stakeholders, particularly from Irrigation and Water Resources Departments, is a major challenge. The 2018 Ganga E-flows notification, while a positive step with specific flow quantifications and monitoring responsibilities, faces challenges in monitoring and enforcement due to the absence of designated authorities and real-time data systems (SCADA). Lack of Standard Operating Procedures (SOPs) for project authorities and the frequent bypassing of E-flows requirements by projects prioritizing power generation further complicate implementation. The lack of consideration for hydrological factors in E-flows calculations and the impact of engineered diversions and consumptive requirements are also significant hurdles. Mr. Mathuria points out the theoretical nature of E-flows discussions in river stretches without engineered diversions and the complexities arising from surface and subsurface water interactions, as well as the potential role of E-flows in addressing issues like salinity ingress. He concludes by emphasizing the need for

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well-understood release mechanisms, financing for monitoring, and penalties for non-compliance. Regarding methodologies, he highlights the availability of guidance documents but stresses on context-specific applications.

The session concludes with a discussion on the interplay between industrial pollution standards and E-flows, the limitations of dilution-based approaches in altered river systems, and the need to focus on water use efficiency in agriculture and industry as integrated solutions. The success of organic farming promotion near the Ganga floodplains is noted as a positive step towards reducing agricultural impact.

GIST

This session examines the state of E-flows implementation in India, highlighting both progress in the Ganga Basin and significant challenges in extending it nationwide. Key themes include the need for a holistic understanding of E-flows, involving diverse stakeholders, addressing implementation hurdles like monitoring and data, exploring alternative flow restoration methods beyond dams (wetlands, groundwater, agriculture), and tackling industrial pollution in the context of E-flows requirements. The session emphasized a move towards practical implementation and adaptive management, acknowledging the complexity and the need for tailored solutions for India's diverse river systems.

KEY TAKE AWAY POINTS

- **Progress in Ganga, but Nationwide Implementation Lags:** While E-Flows are notified and monitored in parts of the Ganga, extending this to other basins remains a major challenge.
- **E-flows are Multifaceted:** They require the right quantity, timing, and quality of water for ecological functions.
- **Stakeholder Engagement is Crucial:** Water resources departments alone cannot implement E-flows; other sectors like irrigation and power need to be involved.
- **Address Trade-offs in Over-allocated Basins:** Integrating E-flows allocations into existing water use in stressed basins requires negotiation and capacity building.
- **Beyond Dams:** Wetlands, groundwater recharge, and agricultural water efficiency are vital components of E-flows implementation.
- **Implementation Challenges are Significant:** Lack of monitoring authorities, SOPs, and real-time data hinder effective E-flows management.
- **Industrial Pollution Requires a Shift:** Relying on dilution is insufficient; water use efficiency and cleaner technologies in industries are necessary.
- **Agriculture is Key:** Improving water use efficiency in agriculture can significantly contribute to river flows.
- **Tailored Methodologies are Essential:** E-flows definition and assessment algorithm needs to be notified by the Central Government, and a protocol should be adapted to the specific characteristics of different stretches for each river by the local governing agency/ institution/organisation.
- **Adaptive Management is Necessary:** E-flows regimes need periodic review and adjustments based on river dynamics and climate impacts.

TRACK B - IWIS | SESSION B2

December 04 - 06, 2024

Challenges in Adopting Nature Based Wastewater Treatment Options

Day 2:
Thursday; December 5, 2024
1130 – 1300 hrs

Moderator:
Dr. P Bose (IIT Kanpur)

Key Speakers:
Mr. D P Mathuria (Chief Engineer, CWC)
Dr. Kaveri Devaiah (VVKI, Bengaluru)

Panelist/ Lead Discussant:
Dr. Harsimran Kaur (IIT BHU)
Dr. B B Sahu (NIT Rourkela)
Dr. S K Singh (MBM University Jodhpur)
Dr. R C Vaishya (MNNIT, Allahabad)
Dr. Asghar Nawab (Wetlands International South Asia, New Delhi)
Mr. Siddhartha Baidya (WWF India, New Delhi)
Mr. Arjit Mishra (WWF India, New Delhi)
Dr. Deepak Singhania (IIT Gandhinagar)
Dr. R L Narendran (Tamil Nadu Pollution Control Board)
Mr. A Rajaram (Tamil Nadu Pollution Control Board)
Mr. D K Singh (Delhi Pollution Control Committee)
Mr. Sunil Kumar Goyal (Delhi Pollution Control Committee)
Mr. Avtar Singh (Punjab Pollution Control Board)
Mr. Jaspal Singh (Punjab Pollution Control Board)
Dr. Sanjay Kumar Singh (Rajasthan State Pollution Control Board)
Mr. Sumit Sharma (Rajasthan State Pollution Control Board)
Mr. Bipin Singh (SMCG, Uttar Pradesh)
Mr. Ashutosh Dash (Govt. of Odisha)
Dr. Arun Goel (NIT Kurukshetra)
Mr. Shahid Mohd Shah (Govt. of Manipur)
Mr. Indrajeet Uike (WRD, Raipur)
Mr. P K Pal (WRD, Raipur)
Mr. Dharmendra Meshram (WRD, Kanker)
Mr. Nohar Singh Dhruv (WRD, Raipur)
Dr. Vimal Mishra (IIT Ghandhinagar)
Mr. Amit Kumar (Uttarakhand Jal Sansthan, Mussoorie)
Mr. Shri Ranjeet Singh (Jalaun Forest Division, Jalaun)
Dr Sandeep Singh (Walia Dept of Agriculture & Farmer's Welfare Punjab)
Mr. M Naveen Goud (MRDCL, Hyderabad)
Mr. G Varun Kumar (MRDCL, Hyderabad)

SETTING THE SCENE

Conventional wastewater treatment – especially sewage treatment – generally has significant capital and operating costs, consumes much electricity and chemicals, and generates sludge that may require further treatment for safe disposal or reuse. On the other hand nature-based solutions, or NBS, that use or mimic natural waterbodies and rivers for wastewater treatment, claim to be advantageous in these respects and eco-friendly. Hence many types of NBS have been proposed by various experts and private entities for a long time, but without wide application on the ground. Their actual efficacy and viability are therefore largely subjective. A four-layer treatment process for municipal wastewaters combing conventional treatment with NBS was specifically recommended by cGanga, vide the River Restoration and Conservation Manual. But, Indian regulatory authorities do not have specific norms or guidelines for NBS methods, which – among other factors – has hindered their adoption in India. It is, therefore, necessary to consider the possible technical, regulatory and societal difficulties in implementing naturebased wastewater treatment solutions.

DISCUSSION

This session, initiated by Dr. Kaveri Deviah, explores the efficacy and potential of NBS for river rejuvenation and water conservation, drawing upon the experiences of the Art of Living Social Projects and broader examples. The discussion highlights numerous success stories across India, including the rejuvenation of over 70 river streams through afforestation and water conservation structures like water pools, recharge wells, and check dams, often driven by community mobilization. Specific projects like the Naganadi River rejuvenation led by women and the revival of the dried-up Kumudvati River are cited as impactful examples. The integration of sustainable agricultural practices and climate-resilient afforestation further underscores the

A four-layer treatment process for municipal wastewaters combing conventional treatment with NBS was specifically recommended by cGanga, vide the River Restoration and Conservation Manual.

potential of NBS. The Jaltara, a simple rainwater harvesting pit, demonstrates effective groundwater recharge at the grassroots level.

Dr. Deviah elaborates on the mechanisms of NBS, such as the role of boulder checks in aeration and increasing dissolved oxygen, the ability of trees to absorb heavy metals, and the potential of algae (phyto-remediation) to become a food source in aquatic ecosystems. A detailed account of a successful lake rejuvenation project showcases significant reductions in COD and BOD and an increase in dissolved oxygen through a combination of natural vegetation, aerators, and fountains. The session also features a nature-based Sewage Treatment Plant (STP) on campus, utilizing biofilters (stones, plants, and microorganisms) to achieve remarkable reductions in BOD, COD, and ammonia-nitrogen, complying with Pollution Control Board standards.

Despite these successes, the session addresses key challenges in implementing and scaling up NBS. The rapid growth of certain phyto-remediation agents like water lettuce necessitates ongoing maintenance. For larger rivers, implementing NBS for sewage treatment poses a greater challenge in terms of land requirements. Other hurdles include apathy towards the perceived slower pace of NBS compared to electro-mechanical-chemical methods, the need for standardized protocols for industrial effluents, and the limited research in areas like microbial consortia for sewage consumption.

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Challenges in Adopting Nature Based Wastewater Treatment Options

Mr. Mathuria provided a valuable counterpoint and clarification, emphasizing that conventional STPs also rely on natural processes (microbes) but within concrete structures. He cautions against oversimplifying the application of NBS for complex industrial effluents without thorough research. However, he acknowledges the proven efficacy of various NBS, citing successful examples like natural wetlands treating Calcutta's sewage, aerated lagoons for LPG plant wastewater, and constructed wetlands for railway and township effluents. The session identifies the lack of uniform protocols and guidelines as a significant barrier to wider adoption, noting that NMCG has since formalized guidelines for constructed wetland treatment systems.

Further challenges discussed include the perceived land footprint (argued to be a myth), operational maintenance (now addressed by guidelines), and the potentially lower capital investment being seen as a disadvantage by stakeholders seeking larger funds. Design flaws, improper vegetation management, inadequate planting time, and poor water quality data in DPRs are also highlighted as critical issues affecting the performance of NBS. The impact of high salinity on the effectiveness of constructed wetlands is noted as a significant constraint.

GIST

This session champions nature-based solutions (NBS) as a viable and often effective approach for river rejuvenation and water conservation, showcasing successful implementations across India. While highlighting the ecological and economic benefits of NBS, the discussion also critically examines the challenges hindering their widespread adoption, including maintenance requirements, land considerations, lack of standardized protocols, design flaws, and motivational factors. The session concludes by emphasizing the need for robust design, proper operation and maintenance, capacity building, and a shift in mindset to fully leverage the potential of NBS for sustainable river management.

The session concludes with a focus on overcoming these challenges, emphasizing the importance of sound design, proper vegetation management, capacity building for operators, frequent inlet inspection, and equalization systems to handle diurnal flow variations. The crucial role of the motivational factor of those conceptualizing and implementing NBS is stressed, along with the need to integrate resource and revenue economization through recycling and reuse. The potential of targeted communication and education, particularly involving children, for long-term behavioural change and the need for system-based scalability are also highlighted.

KEY TAKE AWAY POINTS

- NBS offer proven and often cost-effective solutions for river rejuvenation and water conservation. Numerous successful examples exist across India.
- Community mobilization and local knowledge are crucial for the success of NBS initiatives.
- NBS mimic natural processes and provide multiple ecosystem services.
- Maintenance is essential for the long-term effectiveness of NBS. This includes managing plant growth and ensuring proper functioning of structures.
- Land footprint is often a perceived myth; NBS can be implemented with reasonable land requirements.
- Lack of standardized protocols and guidelines has been a barrier, but NMCG has made progress in this area.
- Sound design, proper vegetation management, and operator training are critical for the success of constructed wetlands.
- Accurate water quality data and careful consideration of inflow characteristics are essential for effective NBS design.
- The motivational factor of implementers and integrating resource recovery are important for wider adoption.
- Scaling up NBS requires addressing challenges related to design, maintenance, and overcoming mindset barriers.
- Learning from successful case studies and developing standardized protocols are key to broader implementation.
- Integrating NBS with conventional treatment systems can offer a holistic approach to wastewater management.

TRACK B - IWIS | SESSION B3

December 04 - 06, 2024

River Monitoring – Real Time Sensor Based vis-à-vis Participative

Day 2:
Thursday; December 5, 2024
1400 – 1530 hrs

Chair: Mr. Rajeev Kumar Mital (DG, NMCG, New Delhi)
Moderator: Dr. Vinod Tare (Former Professor, Founder & Advisor, cGanga, IIT Kanpur)

Panelist/ Lead Discussant:
Dr. Samir Bajpai (NIT Raipur)
Dr. Kishanjit Kumar Khatua (NIT Rourkela)
Dr. B B Sahu (NIT Rourkela)
Dr. Minakshee Mahananda (NIT Rourkela)
Dr. Priyank Sharma (IIT Indore)
Dr. B Sridharan (IIT Palakkad)
Mr. P K Mishra (CPCB)
Dr. R C Vaishya (MNNIT, Allahabad)
Mr. Mohd Alam (WWF India, New Delhi)
Mr. Madhuri Kumari (Noida)
Mr. Nitin Kaushal (WWF India, New Delhi)
Mr. Gitanjali Kanwar (WWF India, New Delhi)
Mr. Sanjeev Yadav (WWF India, New Delhi)
Mr. Arjit Mishra, (WWF India, New Delhi)
Dr. Deepak Singhania (IIT Gandhinagar)
Mr Kuldeep Singh (Punjab Pollution Control Board)
Dr. R L Narendran (Tamil Nadu Pollution Control Board)
Mr. A Rajaram (Tamil Nadu Pollution Control Board)
Mr. D K Singh (Delhi Pollution Control Committee)
Mr. Sunil Kumar Goyal (Delhi Pollution Control Committee)
Mr. Avtar Singh (Punjab Pollution Control Board)
Mr. Jaspal Singh (Punjab Pollution Control Board)
Dr. Sanjay Kumar Singh (Rajasthan State Pollution Control Board)
Mr. Sumit Sharma (Rajasthan State Pollution Control Board)
Mr. Bipin Singh (SMCG, Uttar Pradesh)
Mr. Ashutosh Dash (Department of Water Resources, Govt. of Odisha)
Dr. Baldev Setia (NIT Kurukshetra)
Dr. Arun Goel (NIT Kurukshetra)
Dr. P K Baburajan (Kerala State Pollution Control Board)
Dr. M A Shiju (Kerala State Pollution Control Board)
Dr. Vimal Mishra (IIT Ghandhinagar)
Mr. Amit Kumar (Uttarakhand Jal Sansthan, Mussoorie)
Mr. M Naveen Goud (MRDCL Hyderabad)
Mr. G Varun Kumar (MRDCL Hyderabad)

SETTING THE SCENE

Real-time sensor-based monitoring of river flows and water quality have been tried out and adopted to some extent in various countries including India. The results have been a mixed lot, viz.: (i) measurement of flow rates and certain physical and inorganic parameters are technically reliable, but many biochemical and biological parameters are unsuited for instant and automated measurement; (ii) the capex and opex costs of sensors may be high, and hence generating real-time sensor based data would be high; and (iii) since such data generation is automated, their accuracy and reliability is subject to machine errors, demanding regular and frequent verification by standard measurement methods, which would add to the cost of data generation. Such disadvantages and costs need to be compared to standard manual methods, with the latter being less susceptible to gross errors as well as providing gainful employment to more people. Since many basic measurements by standard method do not need sophisticated instruments or training, they can also be carried out by riverside communities and nearby college/ school students with minimal training and at little cost, avoiding the expenses and time delays due to distant transport of river samples or people. Engaging riverside communities can not only help them in expanding their livelihood opportunities, but also generate valuable interest of such communities and students in scientifically understanding rivers and helping in their conservation. The relative advantages and disadvantages of such participatory river monitoring and automated river monitoring should be assessed in order to adopt the best-suited methods in India.

DISCUSSION

This session delved into the critical aspects of River Health Monitoring, exploring the current state-of-the-art, challenges, and future strategies for a comprehensive and effective system. Dr. Tare initiated the discussion by outlining the vision of integrating real-time monitoring with participative monitoring, empowering riverside communities to contribute data using readily available devices. The Central Pollution Control

Board (CPCB) has already installed real-time stations, providing valuable data for analysis. The session focuses on river monitoring, distinct from effluent monitoring, and examines the reliability of various sensors for parameters like pH, conductivity, BOD, COD, nitrogen, and phosphorus.

Dr. Tare presented findings from a study analysing 4.5 years of real-time sensor data, revealing potential limitations, particularly for parameters beyond pH, conductivity, and dissolved oxygen. The study suggests that optical sensors can be sensitive to background conditions and may sometimes rely on mathematical correlations rather than independent measurements. Global practices indicate that even in developed regions like the Murray-Darling and Rhine River Basins, traditional sampling and laboratory analysis remain preferred over solely relying on real-time sensor data for regulatory purposes, highlighting the current limitations of the technology.

The discussion then shifts to comprehensive river health monitoring, encompassing hydrology, hydraulics, water quality, geography, geomorphology, and biological profiles. While agencies like the Central Water Commission (CWC) monitor discharge in higher-order rivers, data for lower-order rivers is scarce. Traditional manual monitoring by institutions like IIT Kanpur has limitations in data management. The need for coordinated and expanded monitoring efforts, including heavy metals and biological profiling (e.g., macroinvertebrates), is emphasized. The vision of empowering riverside communities for continuous, participative monitoring, especially in lower-order rivers, through mobile laboratories and collaboration with academic institutions, is presented as a promising approach to enhance data availability and community engagement.

Mr. P K Mishra from CPCB provided the perspective of the national water quality monitoring network, which has grown significantly since 1977. He acknowledged questions about the accuracy of one-time samples and highlights CPCB's quality assurance guidelines. Dr. Tare emphasized the lack of a robust data management system for manual monitoring and raises

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the question of the government acting as regulator, operator, and client simultaneously. This leads to the consideration of integrating private participation through data purchase models like Build-Operate-Transfer (BOT) contracts, where third-party Data Qualification Services (DQS) handle QA/QC, significantly improving data consistency. The need for tamper-proof real-time monitoring systems with robust data validation is also stressed.

The future direction, as proposed by Dr. Tare and supported by Mr. Mishra, is a hybrid model combining participatory monitoring with scientific data collection from both manual and real-time methods. This approach aims to optimize the monitoring network by strategically placing real-time stations in hotspot areas for rapid detection of pollution events.

Mr. Nitin from WWF-India shared the successful 10-year experience of community-based river health assessment along the Ganga and Ramganga, utilizing local stakeholders and simplified kits. This approach is particularly valuable for ungauged and unmonitored smaller river systems. The positive impact of engaging local communities in identifying river health issues is highlighted, with examples from the Vyas River in Punjab. The importance of validating community-generated data with lab testing is also noted.

Experiences with real-time online monitoring in Ludhiana reveal challenges related to discrepancies between online reports and actual site readings, as well as sensor issues, necessitating regular calibration. The evolution of the national RTWQM program highlights the initial over-monitoring of unnecessary parameters and the importance of flexible calibration cycles. The need to complement real-time data with auxiliary techniques like monitoring gaseous species as indicators of pollution mixing is suggested. The potential of LIDAR techniques and image processing for measuring river surface velocity and discharge offers an innovative, non-contact method for water quantity assessment.

The discussion converges on the importance of making monitoring data public to leverage the talent in the country for analysis and insights, with the caveat of ensuring data reliability. The need for a Water Quality Index (WQI), similar to the Air Quality Index (AQI), to inform the public is also considered. The "Adopt a River" program is proposed as a mechanism to involve universities, schools, and local communities in analysing real-time data from specific river stretches.

Finally, Mr. Rajeev Mital, DG, NMCG giving his closing remarks concluded by emphasizing that manual and real-time monitoring are not mutually exclusive but complementary. A hybrid approach, integrating various methods and technologies, is deemed the most effective future strategy. The importance of testing and validating monitoring methods across different river types and involving communities and academic institutions in data collection and analysis is underscored to generate reliable data for policy decisions and research.

GIST

This session explores the current state and future of river health monitoring in India. It critically examines the capabilities and limitations of real-time sensors, advocates for a hybrid model integrating real-time and traditional manual monitoring and strongly promotes participatory monitoring by empowering local communities. The discussion highlights the need for robust data management, quality assurance, and making data public for broader analysis and engagement. The session also explores innovative technologies like LIDAR and the importance of focusing on key parameters and discharge measurements for a comprehensive understanding of river health. Ultimately, a collaborative and integrated approach involving government agencies, academic institutions, local communities, and technological advancements is deemed crucial for effective and sustainable river health monitoring.

KEY TAKE AWAY POINTS

- A hybrid approach integrating real-time, manual, and participatory monitoring is the most promising strategy for comprehensive river health assessment.
- Real-time sensors offer high-frequency data but have limitations in reliability for certain parameters and require robust QA/QC.
- Participatory monitoring empowers communities, enhances data density, and fosters a sense of ownership towards rivers.
- Making reliable river health data public is crucial for transparency, research, and public awareness (towards a WQI).
- Discharge data is often more critical than water quality data for understanding basin health, especially during low flow conditions.
- Integrating innovative technologies like LIDAR and gas sensors can enhance monitoring capabilities.
- Collaboration among government agencies (CPCB, CWC), academic institutions, NGOs, and local communities is essential for effective monitoring.
- Focusing on key parameters relevant to specific river health aspects is important for efficient monitoring.
- Data validation and quality assurance are paramount for the reliability of all monitoring methods.
- "Adopt a River" programs can effectively engage educational institutions and communities in river health monitoring and data analysis.

Strategy for Closing the Water Loop at Appropriate Local Scale

Day 2:
Thursday; December 5, 2024
1600 –1745 hrs

Moderator: Dr. Vinod Tare
(Former Professor, Founder & Advisor, cGanga, IIT Kanpur)

Panelist/ Lead Discussant:
Dr. B Sridharan (IIT Palakkad)
Dr. Mohd Alam (WWF India, New Delhi)
Dr. B R Chahar (IIT Delhi)
Mr. Siddhartha Baidya (WWF India, New Delhi)
Dr. R L Narendran (Tamil Nadu Pollution Control Board)
Mr. A Rajaram (Tamil Nadu Pollution Control Board)
Mr. D K Singh (Delhi Pollution Control Committee)
Mr. Sunil Kumar Goyal (Delhi Pollution Control Committee)
Mr. Avtar Singh (Punjab Pollution Control Board)
Mr. Jaspal Singh (Punjab Pollution Control Board)
Dr Sanjay Kumar Singh (Rajasthan State Pollution Control Board)
Mr. Sumit Sharma (Rajasthan State Pollution Control Board)
Mr. Bipin Singh (SMCG, Uttar Pradesh)
Mr. Rahul Sachdeva (NIUA, New Delhi)
Mr. Yasmin L. Rasheed (Land Use Commissioner, Kerala)
Mr. Ashutosh Dash (Department of Water Resources, Govt. of Odisha)
Dr. Roopesh G. Krishnan (Central Ground Water Board, Kerala)
Dr. Aneesh Kumar V (Central Ground Water Board, Kerala)
Mr. P Kodanda Rao (Ground Water and Water Audit Department, Vijaywada)
Mr. A Viseswara Rao (Ground Water and Water Audit Department, Vijaywada)
Mr. S Karimulla Basha (District Ground Water Dept, YSR Kadapa)
Mr. P K Pal (WRD, Raipur)
Mr. Dharmendra Meshram (WRD, Kanker)
Mr. Nohar Singh Dhruv (WRD, Raipur)
Dr. Vimal Mishra (IIT Gandhinagar)
Mr. Amit Kumar (Uttarakhand Jal Sansthan, Mussoorie)
Mr. Shailesh Kumar Yadav (UP Jal Nigam, Mau)
Mr. Ranjeet Singh (Jalaun Forest Division, Jalaun)
Mr. Ambili G K (CWRDM, Kerala)
Dr. Sandeep Singh Walia (Dept. of Agriculture & Farmer's Welfare Punjab)
Mr. Gurlal Singh (WRD, Punjab)
Mr. M Naveen Goud (MRDCL Hyderabad)
Mr. G Varun Kumar (MRDCL Hyderabad)
Dr. Hema Patel (NMCG, New Delhi)

SETTING THE SCENE

Water crisis has been an increasingly ominous prospect in many parts of India, especially in urban centres – as evident in Delhi, Chennai and Bengaluru, while many smaller cities and townships also face such hardships in late winter and summer. Conversely, urban flooding has been an increasing menace in many cities. To overcome this double challenge of alternating water scarcity and water surplus, closing the local water use cycles in urban areas at local levels is obviously needed. A plan for closing this loop was proposed by cGanga by localized wastewater treatment and water recycling using urban waterbodies as local storage reservoirs in urban areas for 330 relatively dry days of a year. This would also help in improving the water environment and aesthetics in urban settlements and promote healthy biodiversity. Such waterbodies, with their storage capacities and drainage routes intact, would also act as buffers against urban flooding on the remaining 35 wet days of the year. A plan for optimizing water recycling and reuse at the local scale to enhance water security, therefore, needs to be comprehensively assessed.

DISCUSSION

This session delved into the critical need for a paradigm shift in urban water management, advocating for decentralized wastewater treatment and a holistic approach that integrates natural processes, resource reuse, and context-specific planning. The discussion highlighted the inefficiencies of centralized systems, the potential of treating wastewater at the source, and the importance of valuing water appropriately.

KEY THEMES AND ARGUMENTS:

- **Paradox of Water Availability:** India faces a unique challenge of having "too much" water for a limited period (say 35 days leading to flooding) and being surrounded

A plan for closing this loop was proposed by cGanga by localized wastewater treatment and water recycling using urban waterbodies as local storage reservoirs in urban areas for 330 relatively dry days of a year. This would also help in improving the water environment and aesthetics in urban settlements and promote healthy biodiversity.

by "wastewater" for the remaining 330 days. Current strategies heavily rely on interception and diversion to centralized treatment plants located away from urban areas.

- **Inefficiencies of Centralized Systems:** This approach necessitates extensive and often unavailable or poorly maintained sewer lines, leading to sewage not reaching treatment plants and treated water requiring energy-intensive transportation back to potential users.
- **Decentralization as a Solution:** The core argument is for decentralized wastewater treatment plants (DWWTs) located where sewage is generated. Treating wastewater at the source reduces conveyance costs, allows for the reuse of treated water within the locality, and transforms "wastewater" into a valuable resource.
- **Nature-Based Treatment:** Integrating natural systems like wetlands and root zones into the treatment process is proposed as a cost-effective and environmentally friendly approach, reducing reliance on energy-intensive advanced technologies.
- **Valuing Water and Resource Recovery:** The discussion emphasizes the need to value water appropriately, moving beyond the perception of it being a free resource. Treated wastewater should be seen as a resource for irrigation, industrial use, and even replenishing natural water bodies.

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Strategy for Closing the Water Loop at Appropriate Local Scale

Recovering valuable components like nitrogen and phosphorus from wastewater needs optimized strategies.

- **Fit-for-Purpose Standards:** Uniform, stringent standards for treated wastewater may not always be necessary. Standards should be tailored to the intended use of the treated effluent, balancing environmental protection with economic feasibility.
- **Urban River Management Plan (URMP):** The concept of a comprehensive URMP is reiterated, emphasizing the need for city-specific plans that integrate decentralized treatment, water body rejuvenation, and sustainable water management practices.
- **Importance of Planning and Data:** Proper planning based on accurate data (topography, connectivity, population density, digital elevation models) is crucial for effective implementation of decentralized systems and resource optimization. Investing in data collection through modern technologies like Lidar, drone surveys is essential.
- **Public Participation and Psychology:** Public perception and acceptance of treated water are significant factors. Demonstrating the benefits of clean water and involving communities in the management of decentralized systems can shift sentiments.





- **Economic Viability and Market Creation:** Identifying local markets for treated water (e.g., industries, horticulture) can create revenue streams that offset treatment costs and incentivize sustainable practices.
- **Integration with Natural Water Bodies:** Treated wastewater should ideally be used to replenish and revitalize natural water bodies, enhancing their ecological value and potential as water sources.
- **Addressing Industrial Pollution:** Segregating industrial wastewater from domestic sewage is crucial due to the presence of heavy metals and other hazardous substances. Industries should bear the cost of treating their own effluents.
- **Role of Policy and Governance:** Supportive policies and effective governance are essential for driving the shift towards decentralized systems, promoting resource reuse, and enforcing appropriate standards.

GIST

The session advocates for a fundamental shift from centralized to decentralized urban water management. By treating wastewater at the source and integrating natural processes, cities can reduce conveyance costs, reuse treated water as a valuable resource and rejuvenate local water bodies. This approach requires context-specific planning based on accurate data, fit-for-purpose standards, public participation, and a change in the perception of water's value. The discussion emphasizes the need for a comprehensive Urban River Management Plan that considers the unique characteristics of each city and prioritizes closing the water loop at the most appropriate scale.

KEY TAKE AWAY POINTS

- **Decentralization is key:** Treating wastewater locally minimizes conveyance costs and maximizes reuse potential.
- **Nature has a role:** Integrating natural and nature based treatment systems with advanced electro-mechanical-chemical system is cost-effective and sustainable.
- **Value water appropriately:** Recognize treated wastewater as a resource and create local markets for it.
- **Standards should be fit-for-purpose:** Tailor treatment levels to the intended use of the effluent.
- **Comprehensive Urban River Management Plans are essential:** Cities need specific plans integrating decentralized systems and water body rejuvenation.
- **Data-driven planning is crucial: I**nvest in accurate data collection for effective decision-making.
- **Public participation and changing perceptions are vital:** Involve communities and demonstrate the benefits of used treated water.
- **Industrial and domestic sewage should be segregated:** Treat industrial effluents at the source.
- **Optimize land use for treatment:** Consider multi-story STPs in land-constrained areas.
- **Balance centralized and decentralized approaches:** Find the optimal mix based on local context.
- **Focus on closing the water loop:** Maximize reuse and minimize reliance on distant water sources.
- **Shift from uniform to context-specific solutions:** Recognize the unique characteristics of each urban area.
- **Collaboration and systemic change are necessary:** Integrate science, technology, policy, governance, and public participation.

TRACK B - IWIS | SESSION B5

December 04 - 06, 2024

Bio-profiling of River Spaces – Reference, Present & Target Conditions

Day 3:
Friday; December 6, 2024
0930 – 1100 hrs

Key Speakers:
Dr. Nandini Rajamani (IISER, Tirupati)
Dr. J A Johnson (WII, Dehradun)
Dr. Vinod Tare (cGanga, IIT Kanpur)

Panelist/ Lead Discussant:
Dr. Shreyans Kumar Jain (IIT BHU)
Dr. Minakshee Mahananda (NIT Rourkela)
Mr. P S Rana (CIDC, New Delhi)
Dr. R C Vaishya (MNNIT, Allahabad)
Dr. Sharda Kosankar (NEERI, Nagpur)
Dr. Rajeev Raghavan (KUFOS, Kochi)
Mr. Nitin Kaushal (WWF India, New Delhi)
Mr. Sanjeev Yadav (WWF India, New Delhi)
Dr. Arjit Mishra (WWF India, New Delhi)
Mr. D K Singh (Delhi Pollution Control Committee)
Mr. Sunil Kumar Goyal (Delhi Pollution Control Committee)
Dr. Sanjay Kumar Singh (Rajasthan State Pollution Control Board)
Dr. Sumit Sharma (Rajasthan State Pollution Control Board)
Dr. Raj Shekhar (SMCG, Uttar Pradesh)
Dr. Bipin Singh (SMCG, Uttar Pradesh)
Dr. Deepak Swami (IIT Mandi)
Dr. Kala Venkata Uday (IIT Mandi)
Mr. Ashutosh Dash (Department of Water Resources, Govt. of Odisha)
Dr. Anirban Banik (NIT Sikkim)
Dr. Vimal Mishra (IIT Gandhinagar)
Mr. Amit Kumar (Uttarakhand Jal Sansthan, Mussoorie)
Mr. M Naveen Goud (MRDCL Hyderabad)
Mr. G Varun Kumar (MRDCL Hyderabad)
Dr. Hema Patel (NMCG, New Delhi)

SETTING THE SCENE

Rivers are characterized by their biodiversity which best indicates the health or overall state of the rivers. The biotic component of riverine ecosystem biota of riverine habitat or bio-profile of pristine rivers and their floodplains are vastly different from degraded rivers, and in all river rejuvenation and conservation (RRC) efforts the aim is ultimately to recover the original biological profiles. The pristine conditions, however, are generally unknown since human actions have been affecting most rivers since ancient times. But bio-profiles of healthy rivers in pre-industrial or early industrial periods may be known or derived for most rivers, which can be used as target conditions or reference bio-profiles for RRC. The biological compositions, however, can be exhaustive, and monitoring all such species is a Herculean task. For meaningful and practical purposes, therefore, the profiling of selective species or classes of species (especially of micro-organisms) can be adequate as representative of healthy ecological balance in different river stretches subjected to variable anthropogenic impacts on river space, flow rates and water quality. The actual bio-profiles varying with time (diurnal, seasonal, etc.), when compared to the reference bio-profiles, may also be analyzed for changes in river conditions that may be characterized as reversible or irreversible changes. The parameters to be measured, frequency and spatial distribution of measurements, and the significant inferences that can be drawn from analysis of these data sets need to be clearly enunciated.

PROCEEDINGS

1. Introduction and Context:

- The session focused on the need for biological profiling of river spaces to support river rejuvenation and conservation efforts.
- Dr. Vinod Tare introduces the topic, emphasizing the importance of understanding the biological aspects of rivers to achieve effective restoration.
- Speakers include Dr. Nandini Rajamani, IISER Tirupati (expert in biodiversity inventories) and Dr. Johnson, WII Dehradun (expert in river ecology).

2. Why is Biological Profiling Important?

- The core objective of river restoration is to revive and sustain the indigenous aquatic and riparian life.
- Understanding the biological profile of a river is crucial because:
  - It provides a direct measure of river health. A healthy river supports a thriving, diverse, and balanced indigenous biological community.
  - It helps in identifying the specific biological forms that are indigenous to different stretches of the river (e.g., in river Ganga snow trout in cold regions, dolphins in plains).
  - It informs the setting of appropriate environmental flow regimes, ensuring sufficient water quantity and quality to support the target biological life.
  - It allows for effective monitoring of restoration efforts. The return and thriving of indigenous species serve as key indicators of success.
  - It helps in understanding the complex food web dynamics within the river ecosystem.
- The concept of 'river health' is directly linked to the presence and well-being of its indigenous biological communities.

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Bio-profiling of River Spaces – Reference, Present & Target Conditions

3. What is Biological Profiling?

- Dr. Nandini Rajamani explains that biological profiling involves creating comprehensive inventories or lists of all life forms within a river ecosystem.
- These inventories can be categorized in various ways:
  - **Ecotypic/Biotic:** Broad categorization based on ecosystem types (e.g., mangrove ecosystems in estuaries).
  - **Taxonomic:** Lists of species, which can be further categorized (e.g., spatially organized, temporally organized).
  - **Genomic:** Detailed analysis of genetic diversity within species.
- These inventories serve as a baseline for understanding the current state of a river's biodiversity and for tracking changes over time.

4. How to Achieve Effective Biological Profiling:

- Dr. Johnson outlines the key elements to consider when profiling a river:
  - **Riparian Zone:** The health of the riverbank vegetation is crucial for the overall river ecosystem.
  - **Channel Morphology:** The shape and structure of the river channel influence habitat diversity.
  - **Habitat Complexity:** Variations in flow, depth, and substrate create microhabitats for different species.
  - **Biological Communities:** Understanding the composition and function of periphyton, phytoplankton, benthic invertebrates, and fish communities is essential.
  - **Water Quality:** Key parameters like temperature, conductivity, and dissolved oxygen directly impact aquatic life.

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Bio-profiling of River Spaces – Reference, Present & Target Conditions


- He emphasizes the importance of understanding the river continuum concept, which describes how the biological community changes along the length of a river.
- He highlights the role of benthic invertebrates as "workforce" in processing organic matter and the importance of fish as indicators of river health.
- He also introduces the concept of indicator species (e.g., Mahseer for clean water) and umbrella species (whose conservation benefits the entire ecosystem).

5. Steps for Implementing Biological Profiling:

- Stratify the river system: Divide the river into zones based on geological characteristics, land use, and river class.
- Establish permanent monitoring sites: Select representative sites within each zone (e.g., every 5 km) for long-term data collection.
- Collect data on key parameters: Physical habitat, water quality, and biological communities (fish, benthic invertebrates, algae).
- Utilize standardized methodologies: Ensure consistency in data collection and analysis across different rivers and institutions.
- Leverage existing data and expertise: Compile secondary data from various sources and involve local communities and experts in the process.

6. Addressing Challenges and Moving Forward:

- The discussion acknowledges the challenges of implementing large-scale biological profiling and emphasizes the need for a coordinated approach involving multiple institutions and experts.
- Dr. Tare stresses the importance of a team effort and the need to demonstrate the value of biological profiling to secure continued resources and support.
- The session concludes with a call for action, urging participants to collaborate on developing a robust methodology for biological profiling that can be applied across different river basins in India.

KEY TAKE AWAY POINTS

- **Biological profiling is essential for effective river restoration and conservation.** It provides a direct measure of river health, informs management strategies, and allows for monitoring progress.
- **A comprehensive approach is needed.** Profiling should consider all aspects of the river ecosystem, including the riparian zone, channel morphology, habitat complexity, and various biological communities.
- **Standardized methodologies and collaboration are crucial.** A coordinated effort involving multiple institutions and experts is necessary to ensure the quality and comparability of data.
- **Long-term monitoring is vital.** Understanding changes in the biological profile over time is essential for adaptive management and ensuring the sustainability of restoration efforts.
- **Public participation can play a role.** Engaging local communities and leveraging their traditional knowledge can enhance the effectiveness of data collection and monitoring.

TRACK B - IWIS | SESSION B6

December 04 - 06, 2024

Strategic & Revenue Gaps in Circular Economy of STP Sludges and Municipal Solid Residues

Day 3:
Friday; December 6, 2024
1130 - 1300 hrs

Moderator:
Dr. Vinod Tare (Former Professor, Founder & Advisor, cGanga, IIT Kanpur)
Mr. Sanmit Ahuja (Expert Member, cGanga, IIT Kanpur)

Panelist/ Lead Discussant:
Dr. B B Sahu (NIT Rourkela)
Dr. B Sridharan (IIT Palakkad)
Mr. M Hanabusa (NK Japan)
Mr. Mayank Agarwal (NKI India)
Mr. Rishabh Chaudhary (Nippon Koei India Consulting Engineers Pvt. Ltd., New Delhi)
Dr. Sushil Kumar Srivastava (NRCD, New Delhi)
Dr. Sabita Madhvi Singh (NRCD, New Delhi)
Mr. Siddhartha Baidya (WWF India, New Delhi)
Dr. R L Narendran (Tamil Nadu Pollution Control Board)
Mr. A Rajaram (Tamil Nadu Pollution Control Board)
Dr. D K Singh (Delhi Pollution Control Committee)
Mr. Sunil Kumar Goyal (Delhi Pollution Control Committee)
Dr. Sanjay Kumar Singh (Rajasthan State Pollution Control Board)
Dr. Sumit Sharma (Rajasthan State Pollution Control Board)
Dr. Raj Shekhar (SMCG, Uttar Pradesh)
Mr. Bipin Singh (SMCG, Uttar Pradesh)
Mr. Ashutosh Dash (Department of Water Resources, Govt. of Odisha)
Dr. Baldev Setia (NIT Kurukshetra)
Dr. Arun Goel (NIT Kurukshetra)
Dr. P K Baburajan (Kerala State Pollution Control Board)
Dr. M A Shiju (Kerala State Pollution Control Board)
Dr. Vimal Mishra (IIT Ghandhinagar)
Mr. Amit Kumar (Uttarakhand Jal Sansthan, Mussoorie)
Mr. Shailesh Kumar Yadav (UP Jal Nigam, Mau)
Mr. M Naveen Goud (MRDCL, Hyderabad)
Mr. G Varun Kumar (MRDCL, Hyderabad)
Ms. Ishleen Kaur (NIUA, New Delhi)
Dr. Hema Patel (NMCG, New Delhi)

SETTING THE SCENE

Increasing amounts of sludge are being generated from STPs in India every year as more and larger STPs get made. Consequently, safe disposal or reuse of STP sludge has been a mounting problem. On the other hand, Indian agricultural soils generally contain low organic matter – reportedly as low as 0.3-0.4% as per ICAR. Moreover, Soil Organic Matter (SOM) or Soil Organic Carbon (SOC) as well as soil nutrient reserves are being progressively depleted from cultivated soils, leading to deteriorating soil health and increasing soil degradation. There is thus an urgent need to increase SOC by regular addition of organics to enhance the health of Indian soils. Except in situations where municipal sewage gets mixed with industrial effluents, STP sludge is usually quite free of heavy metals and other toxic or harmful compounds. Thus, regular application of digested biosolids from STP sludge in farmlands can be extremely useful to enhance SOC, soil health and soil fertility. This measure can be easily integrated with other productive and sustainable agricultural methods such as conservation agriculture, regenerative agriculture, natural farming, microbial fermentation, and biotechnological innovations. As of now, however, the use of STP sludge for soil improvements has been very limited due to their relatively poor macro-nutrient (N, P, K) contents and

Indian agricultural soils generally contain low organic matter – reportedly as low as 0.3-0.4% as per ICAR. Moreover, Soil Organic Matter (SOM) or Soil Organic Carbon (SOC) as well as soil nutrient reserves are being progressively depleted from cultivated soils, leading to deteriorating soil health and increasing soil degradation.

consequent salability to farmers. Clearly, use of STP sludge – not as fertilizers, but as soil health/ fertility enhancers – is what is needed for sludge management and India's sustainable development.

DISCUSSION

This session focuses on the growing challenge of managing the increasing volumes of sludge produced by Sewage Treatment Plants (STPs) across India, driven by significant investments in wastewater treatment capacity. The discussion explores the technical complexities, economic models, and policy considerations necessary to address this issue effectively.

1. Introduction and Context:

- Mr. Sanmit Ahuja sets the stage by highlighting the burgeoning sludge problem due to increased STP capacity. He emphasizes that the cost of sludge treatment and disposal must be internalized within wastewater treatment costs. He also addresses the mischaracterization of biosolids as fertilizer and the need to understand their market potential and economic viability. The primary responsibility for sludge management lies with Urban Local Bodies (ULBs).
- Dr. Vinod Tare outlines the current policy landscape, which largely leaves sludge management to the discretion of ULBs and

Strategic & Revenue Gaps in Circular Economy of STP Sludges and Municipal Solid Residues

EPC contractors without clear guidelines. He points out that the increasing sludge quantities necessitate a more structured approach. He categorized sludge into primary, secondary, mixed, and "plus plus" (containing industrial waste, potentially hazardous). Potential end uses include agriculture, energy production (biogas, fuel), construction materials, and landfilling. The feasibility of each depends on factors like transportation costs, sludge quantity, quality, and distance to end use.

2. Technical Aspects and Characterization:

- Dr. Tare detailed key characteristics for sludge characterization:
  - **Nutrient Content:** Carbon, nitrogen, phosphorus, C/N ratio.
  - **Pathogen Content:** Fecal Coliforms, Total Coliforms, *Salmonella*, Helminths.
  - **Heavy Metals and Emerging Contaminants:** Primarily a concern when industrial waste is mixed with sewage.
- He discussed the need for quality enhancement (sanitization, hygienization, nutrient enrichment) based on the intended end use and the initial sludge quality. Different grading systems and loading rates for agricultural application are mentioned.

3. Economic Models and Funding Gaps:

- The discussion highlights the significant

TRACK B - IWIS SESSION B6

December 04 - 06, 2024

Strategic & Revenue Gaps in Circular Economy of STP Sludges and Municipal Solid Residues

funding gap in viable sludge management solutions. Revenue generation from biosolids is often insufficient to cover treatment and disposal costs.

- The need for a Viability Gap Fund (VGF) is emphasized, and the session explores who should bear this cost – the water sector, the farming sector, or a combination.

4. Decentralization vs. Centralization:

- Dr. P S Rana advocates for decentralized wastewater treatment as a way to minimize sludge mixing, reduce transportation costs, and enable local reuse. Gated communities and group housing can adopt on-site solutions.
- Dr. Tare agrees that decentralized systems inherently produce less concentrated sludge volumes at central locations.

5. Policy Recommendations and Regulatory Framework:

- **Sludge Certification:** A key recommendation is a certification process to differentiate sludge based on the presence of hazardous materials, guiding appropriate disposal and use. Certification could be applied to either sewage input or sludge output.
- **Sludge as a Carbon Supplement:** Viewing sludge primarily as a carbon enhancer for soil, rather than solely as a fertilizer (which requires meeting stringent FCO standards), is proposed. This aligns with addressing the widespread carbon depletion in Indian soils.
- **National Program for Soil Conservation:** Integrating sludge management with a national soil conservation program is suggested, recognizing healthy agriculture soil as a national resource.
- **Internalizing Costs:** The cost of sludge treatment should be internalized within the per cubic meter cost of sewage treatment, making the water sector responsible for its management.
- **NRCD and JICA Initiatives:** Dr. S K Srivastava (NRCD) outlines the existing regulatory framework (Water Act, Hazardous Waste Rules, FCO) and mentions a JICA-funded project aimed at formulating national




guidelines for safe and effective sludge management. Mr. Mayank (JICA project) shares findings from site visits, indicating heavy metal contamination in many STPs, hindering sludge reuse under FCO. He suggests relaxing heavy metal parameters in FCO and a clustered approach for centralized sludge management facilities.

- **Draft Liquid Waste Management Rules 2024:** These draft rules under the EP Act aim to establish environmentally sound management of wastewater, sludge, and fecal sludge, with CPCB responsible for issuing guidelines and standards.

6. Addressing Concerns and Finding Solutions:

- **Farmer Reluctance:** The reluctance of farmers to use sludge, often due to pricing and perceived risks, is discussed. Demonstration plots by KVKs are suggested to showcase the benefits.
- **Emerging Pollutants:** The presence of emerging pollutants in sludge is acknowledged as a concern requiring further research and monitoring SOPs. Soil is currently considered the best sink for these due to its biological diversity.
- **Cost Burden Sharing:** The need for shock absorption in financing sludge management is emphasized, with potential burden sharing across water, agriculture, and forestry sectors.
- **Local Master Plans:** The consensus is that every city needs a comprehensive master plan for sludge management, considering local conditions and the most viable solutions.

KEY TAKE AWAY POINTS

- Sludge management is a critical and growing challenge requiring immediate attention.
- Current policies are inadequate to handle the increasing sludge volumes.
- A multi-pronged approach is needed, encompassing technical, economic, and policy considerations.
- Sludge certification is essential to guide safe and effective reuse or disposal.
- Viewing sludge as a carbon supplement for soil offers a promising avenue for beneficial use.
- Decentralized wastewater treatment can minimize sludge-related issues.
- The cost of sludge management must be internalized within wastewater treatment costs.
- Collaboration between water, agriculture, and other relevant sectors is crucial.
- Comprehensive master plans for sludge management are necessary for every city.
- A robust regulatory framework is needed to govern sludge management practices.

GIST

The session grapples with the escalating challenge of STP sludge management in India. It highlights the need to move beyond ad-hoc practices towards a structured and economically viable approach. Key solutions discussed include sludge certification, recognizing its value as a carbon supplement for soil, decentralized treatment systems, internalizing management costs within wastewater treatment, and developing comprehensive master plans at the city level. The discussion also emphasized the importance of a robust regulatory framework, collaboration between government agencies, and addressing farmer concerns to ensure the sustainable and beneficial reuse or disposal of STP sludge.

TRACK C - CITIS 2024

December 04-06 2024

A Summary of Presentations and Insights

OZONE NANOBUBBLE (ONB) TECHNOLOGY FOR LAND AND POND RESTORATION, GO 4 NET ZERO ENERGY SERVICES PVT. LTD.

Mr. Hariharan *(Joined in Hybrid Mode)*

SUMMARY

By leveraging the power of ONB technology, Go4Net aims to revolutionize lake and pond restoration, providing sustainable and effective solutions to water quality challenges. May cGanga interact for possible environmental technology verification under local conditions.

COMPANY OVERVIEW:

GO 4 NET ZERO ENERGY SOLUTIONS PVT. LTD. is a DPIIT-recognized GreenTech startup developing innovative, cost-effective, and chemical-free water disinfection systems using advanced ozone and nanobubble technologies, supported by a grant from the Department of Science & Technology, Government of India for prototype development; the company is committed to delivering high-quality, sustainable water treatment solutions with optimized CAPEX and OPEX through continuous innovation and invites collaboration with stakeholders to advance eco-friendly water treatment technologies.

Problem:

- **Eutrophication:** Excessive nutrient loading leading to algal blooms.
- **Water Pollution:** Contaminants harming aquatic life and human health.

Solution:

- **ONB Technology:** A novel approach combining ozone and nanobubble technology.
- **Ozone:** A strong oxidizing agent that disinfects water and eliminates contaminants.
- **Nanobubbles:** Tiny bubbles that increase oxygen levels, enhance nutrient breakdown, and improve water clarity.

Benefits of ONB Technology:

- Effective disinfection
- Improved water quality
- Enhanced oxygenation
- Algae removal
- Reduced odour and colour

Key Features of ONB System:

- **Dielectric Barrier Discharge (DBD) Ozone Generator:** Efficient ozone production.
- **Small Nanobubble Size:** Increased surface area for better interaction with water.
- **High Ozone Concentration:** Powerful oxidation and disinfection.
- **Enhanced Dissolution Rate:** Rapid oxygen transfer and distribution.
- **Eco-Friendly:** Minimal environmental impact.

Go 4 Net's Commitment:

- **Innovation:** Developing cutting-edge water treatment solutions.
- **Sustainability:** Promoting eco-friendly and sustainable practices.
- **Customer Focus:** Delivering high-quality products and services.

Problem statement

Lakes and ponds are crucial ecosystems that offer biodiversity, recreation, water supply, and flood control. However, they face significant challenges from water pollution, threatening aquatic life and the communities that depend on them for their livelihoods and well-being.

Eutrophication: Excessive nutrient loading, primarily from agricultural runoff, wastewater discharge, and urban development, leads to algal blooms that deplete oxygen levels and harm aquatic life.

Water Pollution: Contaminants, including heavy metals and chemicals negatively affect water quality and pose risks to human health and aquatic organisms.

Technology description

Ozone

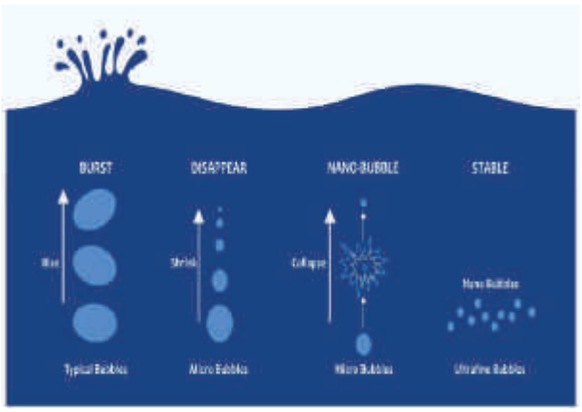
- Strong oxidising agent
- Oxidizes Iron
- Oxidize Organic compound
- Strong disinfectant
- Oxidizes Manganese
- Removes colour

Nano Bubble

- Nano Bubbles are invisible to naked eyes
- High gas transfer ratio
- Large surface area
- Stays in water for long time
- Increases dissolved oxygen

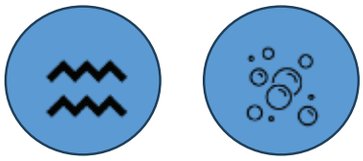
Uniqueness of the solution

ONB technology is unique due to the enhanced achievable disinfection rates and reducing the need for additional chemicals, setting us apart in the water treatment market. Unlike conventional available products, our nanobubbles are smaller, more stable, and provide greater surface area for interaction.



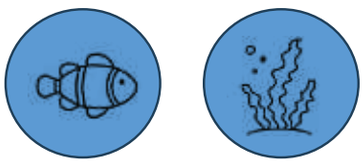
ONB - Key Benefits

The ONB provides following benefits when applied on waterbodies:-



- Act as disinfectant
- Colour removal
- Odour removal
- Chemical oxygen demand reduction

- Biochemical oxygen demand reduction
- Algae removal
- Iron removal
- Manganese removal



- Maintain High DO level

A Summary of Presentations and Insights

DETOXIFY TECHNOLOGIES PVT. LTD. DETOXYFI

Mr. Dhananjay Goel

SUMMARY

DetoXyFi's innovative water filtration technology offers a promising solution to the global water crisis. Their focus on affordability, sustainability, and community engagement positions them well to meet the growing demand for clean water access worldwide.

COMPANY OVERVIEW:

DetoXyFi is a social enterprise dedicated to making clean water a universal human right. Their innovative technology utilizes waste sap wood and eco-friendly chemicals to create affordable, gravity-driven, and biodegradable water filters.

Vision and Mission:

- **Vision:** Provide sustainable, affordable, and accessible clean drinking water solutions globally to marginalized population.
- **Mission:** Develop water filtration technology using waste sap wood to address hygienic water availability.

Product Spotlight:

DetoXyFi's flagship product is a biodegradable water filter created from waste wood. This filter removes pathogens, microplastics, and inorganic pollutants, offering a sustainable and effective solution for clean water access.

Key Strengths:

- **Innovative Technology:** Patented, one-of-a-kind filtration system inspired by nature.
- Comprehensive Contaminant Removal: Removes pathogens, microplastics, and inorganic pollutants.
- **Affordability and Accessibility:** 60% cheaper than alternatives, targeting underserved communities.
- **Sustainability and Energy Efficiency:** Reduces waste and minimizes energy consumption.
- **Community-Centric Approach:** Promotes water education and encourages responsible usage.

Target Market:

- **Primary Focus:** Disaster relief organizations (B2B2C).
- **Expansion Plans:** Governments and NGOs (B2C).
- **Beneficiaries:** Rural and semi-urban communities in developing nations.
- **Global Scope:** Low-income communities worldwide and First Nation communities.

Market Opportunity:

- **Expanding Water Crisis:** Growing demand for sustainable solutions to address water scarcity and contamination.
- **Focus on Sustainability:** Increasing awareness and willingness to adopt eco-friendly alternatives.
- **Emerging Markets:** Potential for significant impact in developing countries.

Scalability and Growth:

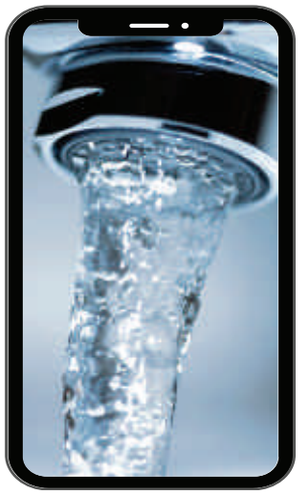
- **Initial Deployment:** Individual-use filters with a one-week lifespan in disaster relief settings.
- **Retail Market Transition:** Transitioning to replaceable filters (monthly lifespan) with a razor-blade model for recurring revenue.
- **Secondary Revenue Streams:** Reselling spent filters and carbon offsets generated by the technology.
- **National and Global Expansion:** Targeting slums in India and disaster-prone regions worldwide.

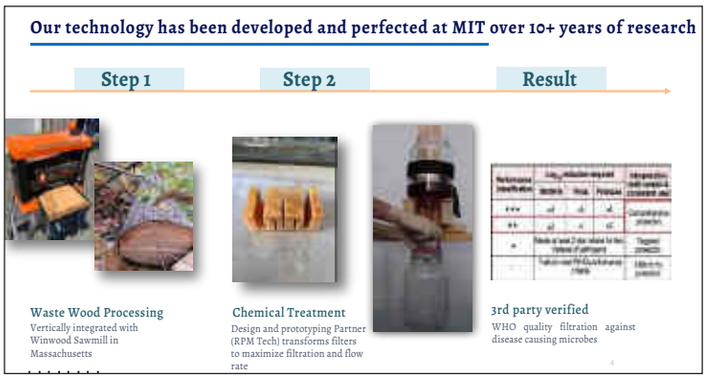
Leadership Team:

- **Dhananjay Goel:** Co-founder & Director (Expertise: Fintech, AI, Sustainable Technology)
- **Rishon Benjamin:** Co-founder & Director (Expertise: Business Administration, Sustainable Design)
- **Dr. Rohit Karnik:** Co-founder & Shareholder (Expertise: Chemical Engineering, Biomedical Engineering)
- **Gita Goel:** Director (Expertise: Business Management)

About us

DETOXYFI TECHNOLOGIES PVT. LTD is dedicated to revolutionizing clean drinkingwater access. Our breakthrough technology harnesses waste wood and eco-friendly chemical processing to create cost-effective, gravity-driven water filters. Derived from sapwood, a by-product of the sawmill industry, our biodegradable filters outperform existing solutions by eliminating pathogens, microplastics, and inorganic pollutants. We're on a mission to make cleanwater a universal human right, ensuring sustainability, affordability, and accessibility for households and individuals worldwide. Join us in tackling the global water crisis and improving lives through innovative, natural, and life-saving solutions.





Our Solutions to the Challenges:-

Cutting-Edge Filtration Tech:

Our breakthrough filtration tech combats scarcity and contamination, offering affordable access to pure drinking water.

Robust Infrastructure:

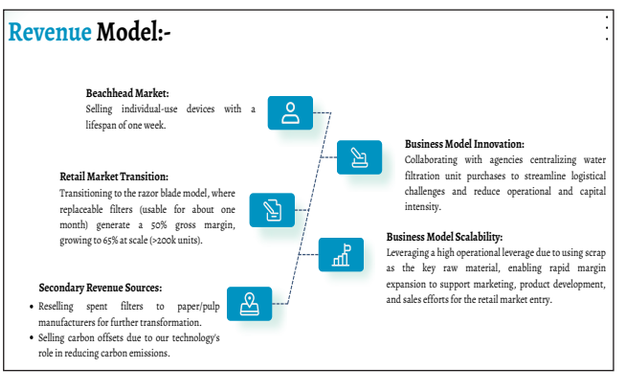
We build resilient water systems, ensuring reliable supply even during crises, safeguarding communities.

Sustainability and Efficiency:

Our solutions are sustainable and energy-efficient, reducing costs while benefiting the environment.

Community Empowerment:

We engage communities, promoting water education, conservation, and responsible usage to address global water challenges.



A Summary of Presentations and Insights

MESHING GEOSCIENCE, CLAIMS DATA AND ML MODELS TO UNDERSTAND THE FUTURE FLOOD RISK, 7ANALYTICS

Ms. Sinah Truffat

SUMMARY

Overall, 7Analytics' innovative approach to flood risk assessment provides a valuable tool for mitigating the impacts of climate change and safeguarding communities.

COMPANY OVERVIEW:

7Analytics is a tech company focused on providing high-resolution property-level flood risk data. By combining advanced machine learning models with extensive geospatial data, they are able to accurately predict flood risk and provide valuable insights to insurers, asset owners, and governments.

Key Points:

- **Leveraging Megatrends:** 7Analytics capitalizes on the increasing frequency and severity of floods due to climate change and urbanization.
- **Innovative Flood Prediction Model:** Their model utilizes a unique combination of:
  - High-resolution geospatial data
  - Historical flood claims data
  - Advanced machine learning algorithms
- **Real-Time Flood Warning Tool:** Provides timely alerts to enable proactive measures and minimize damages.
- **Predictive Risk Scoring:** Offers property-level flood risk assessments to inform insurance underwriting and pricing.
- **Proven Impact:** 7Analytics has demonstrated significant value to insurance partners by improving risk assessment and reducing losses.

Benefits:

- **Enhanced Risk Assessment:** Accurate and detailed flood risk information.
- **Improved Decision-Making:** Informed decisions for insurance underwriting, property investment, and disaster response.
- **Reduced Losses:** Proactive measures to mitigate flood damage.
- **Sustainable Development:** Supporting climate resilience and informed urban planning.

On a mission to offer the best model for predicting floods

- Founded in 2020 with offices in NO, DK and US
- We have built the world's best flood intelligence tool for acute and chronic flood risk, with a focus on urban floods
- Team of 20 talented builders
- 50+ customers in Northern Europe & US

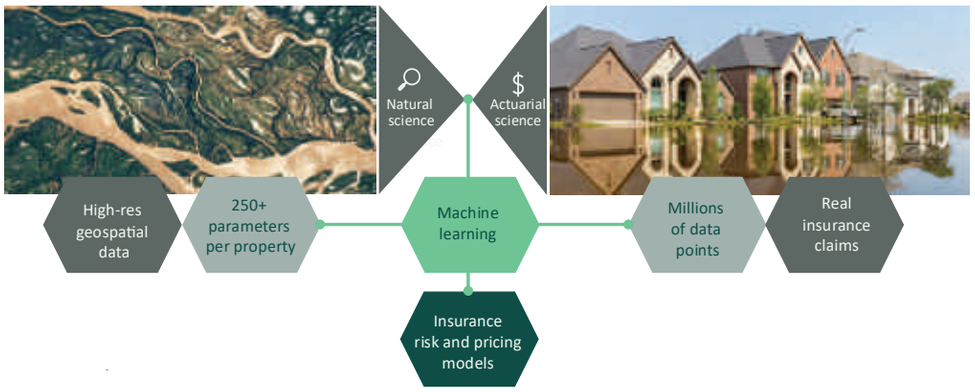
xlp Fremtind JBF

- Presenter at Clinton Global Initiative in 2023, Xtreme Deep Tech finalist 2024 and nominated for the Earthshot Prize 2024

CLINTON GLOBAL INITIATIVE · THE EARTHSHOT PRIZE · The World's Largest Startup Competition

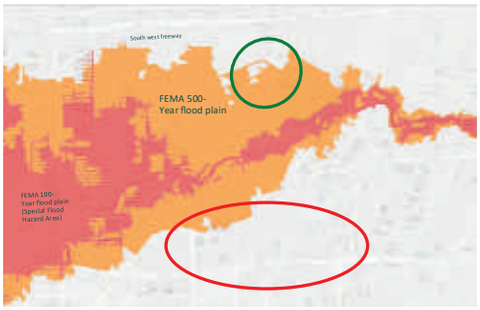
Insurance losses – Weakened first line of defense

Grab market opportunity and stay profitable – Lead on closing the flood protection gap



Vast improvement compared to standard risk information

FEMA channel and river flooding
Low resolution terrain model data
100- and 500-year extent of floodplain
No inundation depths



7Analytics flood prediction model
High resolution terrain model
Detailed flood (inundation) levels
Live and linked to rainfall and sensors

TRACK C - CITIS 2024

December 04-06 2024

A Summary of Presentations and Insights

SEAWEED FOR POLLUTION CONTROL, EQUIL.EARTH

Mr. Rohit Vadhera

SUMMARY

Equil.earth's vision is to establish a sustainable and scalable seaweed industry that addresses global challenges while creating positive environmental and social impact.

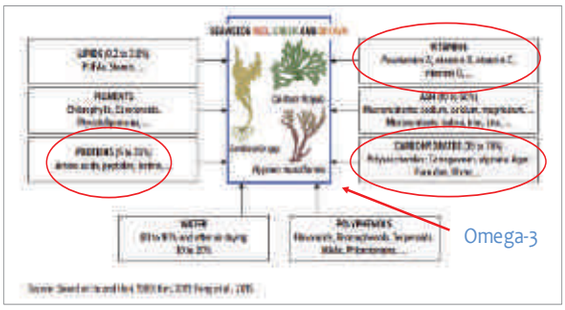
COMPANY OVERVIEW:

Equil.earth is a company dedicated to harnessing the potential of seaweed for environmental and economic benefits. Their innovative approach focuses on onshore cultivation of seaweed, offering a more controlled and sustainable alternative to traditional methods.

Key Points:

- **The Power of Seaweed:** Seaweed is a versatile marine plant with the capacity to absorb carbon dioxide, improve water quality, and provide valuable resources.
- **Challenges in Traditional Cultivation:** Traditional seaweed cultivation often relies on open-ocean methods, which are susceptible to environmental factors and have limited scalability.
- **Equil.earth's Solution:** The company has developed a controlled onshore cultivation system that optimizes seaweed growth, ensuring a consistent and reliable supply.
- **Market Opportunities:** Seaweed-derived products, such as biostimulants and biofuels, have significant market potential. Equil.earth is well-positioned to capitalize on this growing demand.
- **Environmental Impact:** By cultivating seaweed, Equil.earth contributes to carbon sequestration, nutrient removal, and coastal ecosystem restoration.
- **Social and Economic Benefits:** The company aims to create jobs and economic opportunities, particularly in coastal communities.

A highly underplayed regenerative solution:



- A fast-growing plant with amazing properties. Much easier to manage than micro-algae
- More carbon impact/acre than forests with 3-4x higher photosynthetic efficiency
- Low environmental impact. Removal of excess nutrients and all carbonates (alkalinization)

10,000 varied species. Requires expertise to optimise seed and growth. More valuable than wood and crops

Reliable supply – the industry pain point:

Conventional raft seaweed cultivation in Gujarat, India

- 7 M (dry) t/a - mostly from traditional small-holders across Asia using lines, rafts and baskets
- Warmer seas, lack of nutrients and marine challenges have stifled growth in past 5 years
- This is a zero-control environment

Global production is static. Prices for some species have risen to $ 1,400/t (dry). Industry is stressed about reliable future supply as new demand kicks in

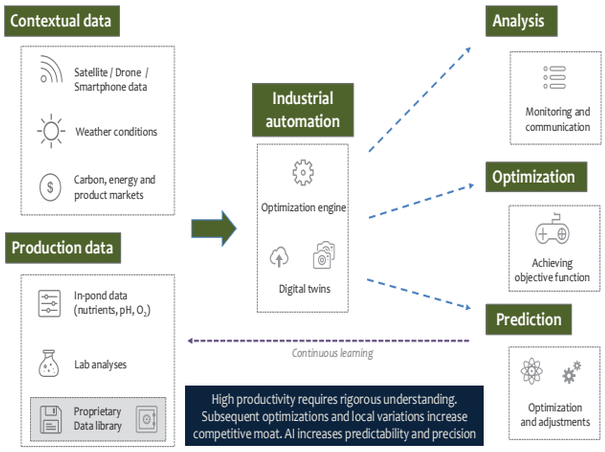
Our solution – develop onshore cultivation:

- Seaweed inputs – CO_2, nutrients, seawater and sunlight
- A high-control alternative
- Plenty of coastal non-arable land
- A US$ 30k pond (250 x 10 m) can produce up to 30 dry t/a of high-quality biomass
- Synergies with energy, desalination and WWT infrastructure

Raceway Pond in Australia

A standardized series of highly optimized raceway ponds creates a low-cost and reliable production platform

First OS for onshore. AI layer adds precision:



High productivity requires rigorous understanding. Subsequent optimizations and local variations increase competitive moat. AI increases predictability and precision

2025 as basis for a scaled business:

Deep understanding
Proprietary level of understanding of the business, with limited sharing to Advisors / competing groups. Deep store of research into upgrading seaweed in India. Model. Team

Finance
Grants and Seed funding. First-mover advantage / high access to infrastructure and project financing. Early development of viable loan program (PaaS)

Sales Channels
Focus on established sales channels, but work to develop own pathways and IP

Site selection and allies
Strict guidelines as to which assets and partners are selected. Avoid risk. Avoid marginal operators. Careful consideration of JV and asset-operation opportunities, which can dilute focus

Government
Develop links at state and central Government level to reduce risks of non-performance and localized interference. Work with CMFRI, TNFU and Bharatia.org

TRACK C - CITIS 2024

December 04-06 2024

A Summary of Presentations and Insights

CLASS A BIOSOLIDS, COLSEN

Mr. Sameer Khan

SUMMARY

By leveraging advanced technologies and a deep understanding of wastewater treatment processes, Colsen is driving the transition towards a more sustainable future.

COMPANY OVERVIEW:

Colsen is a global leader in water, energy, and environmental solutions, specializing in wastewater treatment, waste-to-biogas conversion, and nutrient recovery.

Key Technologies and Services:

- **Thermophilic Digestion:** A high-temperature process that efficiently converts organic waste into biogas and Class A biosolids.
- **Benefits:** Higher biogas production, reduced treatment time, and enhanced nutrient recovery.
- **DIGESTMIX® Technology:** A patented mixing and heating system that optimizes the digestion process.
- **Waste-to-Biogas:** Converting organic waste into renewable energy, reducing greenhouse gas emissions.
- **Nutrient Recovery:** Recovering valuable nutrients from wastewater, such as phosphorus and nitrogen, for reuse in agriculture.
- **Custom Solutions:** Tailored solutions to meet specific client needs and regulatory requirements.

Global Impact:

Colsen operates globally, with a focus on providing sustainable and innovative solutions to water and waste challenges. Their projects contribute to:

- **Environmental Protection:** Reducing pollution and conserving resources.
- **Energy Security:** Producing renewable energy from waste.
- **Circular Economy:** Promoting resource recovery and reducing waste.

TABLE OF CONTENT – Colsen Technologies

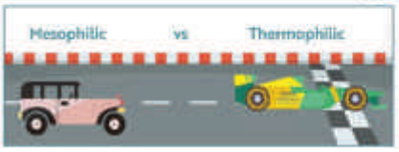
Sludge-to-energy

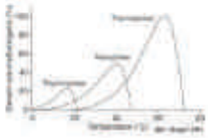
Anaerobic digestion in the Colsen way at 55°C:

- Higher biogas production
- More compact installation
- Biosolids Class A according US EPA 503
- Higher Sludge Degradation (50 Percent VSS Degradation)

Wide range of substrates:

- Manure;
- Food waste;
- Industrial waste;
- Municipal sludge;
- Etc.





Conventional Mesophilic vs. Thermophilic digestion

	Mesophilic	Thermophilic
VS-reduction (biogas production)	Medium	High
HRT	18-25 d	12 - 16 d
Installation size	Bigger	more compact, or more load with the same volume
Class A Biosolids	No	Yes
Power Consumtion	Low	Lower than Mesophilic (Mixer consumes lesser power and no Recirculation Pumps)
Operations	Simple	Simple
Down-time	Low risk, almost none	Low risk, almost none
Heat consumption	Low	Higher, but covered completely by higher biogas production
Dewatering	Good	Good

Class A Biosolids

Alternative 1 for demonstrating Class A pathogen reduction.

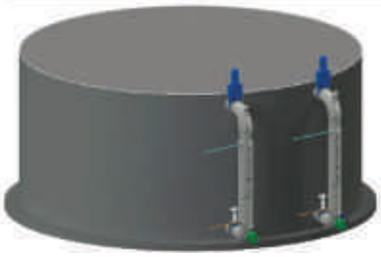
Parameter	Sewage sludge	Sewage sludge
Fecal coliforms	< 1000 MPN / g total solids	< 1000 MPN / g total solids
	OR	
Salmonella spp.	< 3 MPN / 4g total solids	< 3 MPN / 4g total solids
Dry Matter	< 7 %	> 7%
Temperature	> 50°C	> 50°C
Time period	> 30 min	> 20 min
Formula	D = 50.070.000/(10^(0,1400*t)) = 1 day	D = 131.700.000/(10^(0,1400*t)) = 2.6 days

Sludge-to-energy

Selection of Colsen's recent track record at sewage treatment plants

Digester mixing & heating: DIGESTMIX®

DIGESTMIX®: E-efficient mixing + low maintenance heating



Advantages

- ✓ Low energy consumption
- ✓ Prevention of foam and scum
- ✓ No settling of sand
- ✓ No equipment inside tank
- ✓ Easy maintenance
- ✓ Heating and mixing at once

TRACK C - CITIS 2024

December 04-06 2024

A Summary of Presentations and Insights

ACTIVATED FILTER MEDIA, DRYDEN AQUA

Mr. Sameer Khan

SUMMARY

By leveraging the power of AFM® technology, Dryden Aqua is committed to providing innovative and sustainable water treatment solutions for a wide range of applications.

COMPANY OVERVIEW:

Dryden Aqua is a leading provider of innovative water treatment solutions, specializing in AFM® activated filter media.

Key Features of AFM®:

- **Superior Filtration:** High surface area for efficient particle removal and adsorption of contaminants.
- **Bio-Resistance:** Self-sterilizing properties prevent biofilm formation, ensuring consistent performance.
- **Long Lifespan:** Durable and resilient, requiring minimal maintenance.
- **Reduced Backwashing:** Shorter and less frequent backwashes, saving water and energy.
- **Enhanced Water Quality:** Improves water clarity, reduces turbidity, and removes harmful contaminants.

Applications:

- **Swimming Pools:** Clear, clean, and safe swimming water.
- **Water Treatment:** Effective removal of impurities and contaminants.
- **Aquariums and Aquaculture:** Optimal water conditions for aquatic life.

Manufacturing Process:

AFM is produced from recycled glass, making it an environmentally friendly and sustainable solution. The manufacturing process involves a series of chemical and thermal treatments to activate the glass surface and enhance its filtration properties.

Benefits of Using AFM®:

- Improved water quality
- Reduced operating costs
- Increased system reliability
- Enhanced sustainability

About Dryden Aqua

Founded by Dr. Howard Dryden in Scotland

- Marine Biologist, PhD in sand and zeolite filtration
- Leading expert in water treatment

AFM® was originally invented to:

- ✓ Eliminate chloramine and THM production
- ✓ Prevent lung diseases and improve living conditions of sea mammals in captivity

AFM

AFM® Business Areas

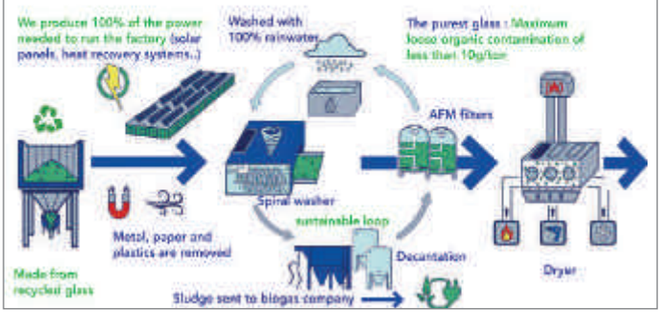
SWIMMING POOLS
+ 500'000 pools equipped

AQUARIA & AQUACULTURE

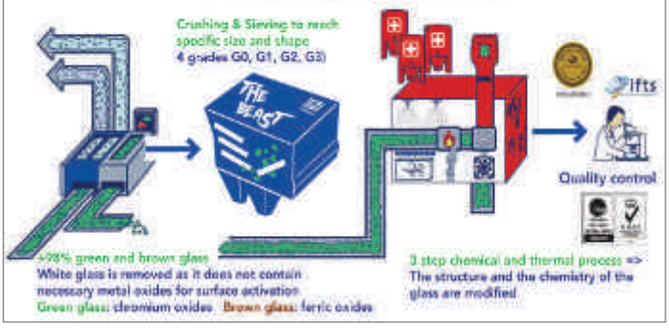
The AFM® technology is successfully used in the following 3 business areas.

WATER TREATMENT

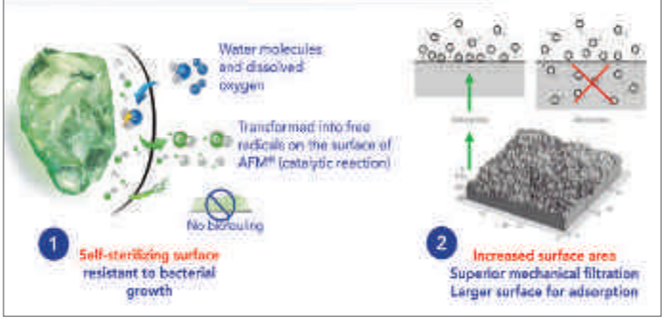
How is activated (glass) filter media manufactured 1/2



How is activated (glass) filter media manufactured 2/2



Self sterilizing & increased surface area

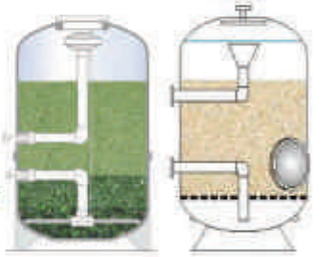


Surface area - activated glass filter media versus sand

Sand
1'000kg = 1'000 m² / 100 lbs = 1'100 ft²*
Bulk Bed Density: 1.56 kg/l = 100 lbs/ft³

Activated filter media
1'000kg = 50'000 m² / 100 lbs = 25'000 ft²*
Bulk Bed Density: 1.26 kg/l = 78 lbs/ft³
*Langmuir Isotherm Method

Ex: Ø 2.340mm / 94" filter = 5m² / 177 ft² of media



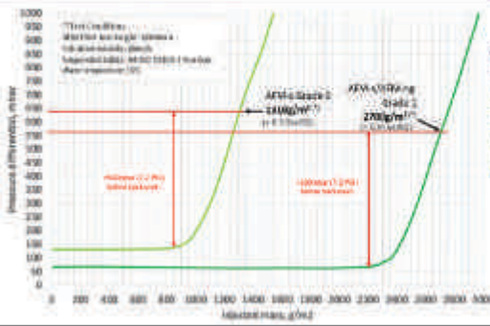
More surface in contact with water
=> Superior mechanical filtration
+ high surface for particle adsorption

AFM: 130.000 m² / 1.45 Mio ft² Sand: 23.000 m² / 250.000 ft²

Performance comparison of AFM® vs. Sand

Parameter	Sand	AFM®	Comments
TSS removal	✓	✓ ✓	Performance in terms of solids removal is 25% - 50% better than sand
Bacteria levels		✓ ✓	AFM® can remove 100 % more bacteria from the water than sand
Iron	✓	✓ ✓ ✓ ✓	AFM® is very good at removing iron and manganese, due to its surface-ion charge
Manganese	✓	✓ ✓ ✓ ✓	
DOC	✗	✓	Sand can generate organic matter, AFM® will remove organic matter
Particle size removal	30 – 40	< 4 µm < 1 µm AFM®ng	AFM® will remove most particles down to 4 micron, but also many sub-micron and dissolved components by surface adsorption
Biofilter capacity	✓	✗	AFM® does not become a biofilter, can subjected to a mechanical coagulation and worm-hole channelling

AFM suspended solids load rate @ 20m/h / 8gpm/ft2



Suspended solids load rate depends on AFM Grade

AFM Grade 1
2 - 6 kg/m² (0.5 - 1.5 lbs/ft²)

AFM Grade 0
1 - 4 kg/m² (0.25 - 1 lb/ft²)

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A Summary of Presentations and Insights

REDUCING GEOLOGICAL RISK IN INFRASTRUCTURE PROJECTS, GEOMODELLING EMERALD

Mr. Andreas A. Pfaffhuber *(Joined in Hybrid Mode)*

SUMMARY

By providing accurate and reliable geological information, Emerald Geomodelling empowers clients to make informed decisions, mitigate risks, and optimize project outcomes.

COMPANY OVERVIEW:

Emerald Geomodelling: Reducing Geological Risk in Infrastructure Projects Emerald Geomodelling is an innovative company focused on addressing the challenges of geological uncertainty in infrastructure projects. By leveraging advanced machine learning and geospatial data, they provide accurate and reliable ground models that reduce risk, cost, and time to market.

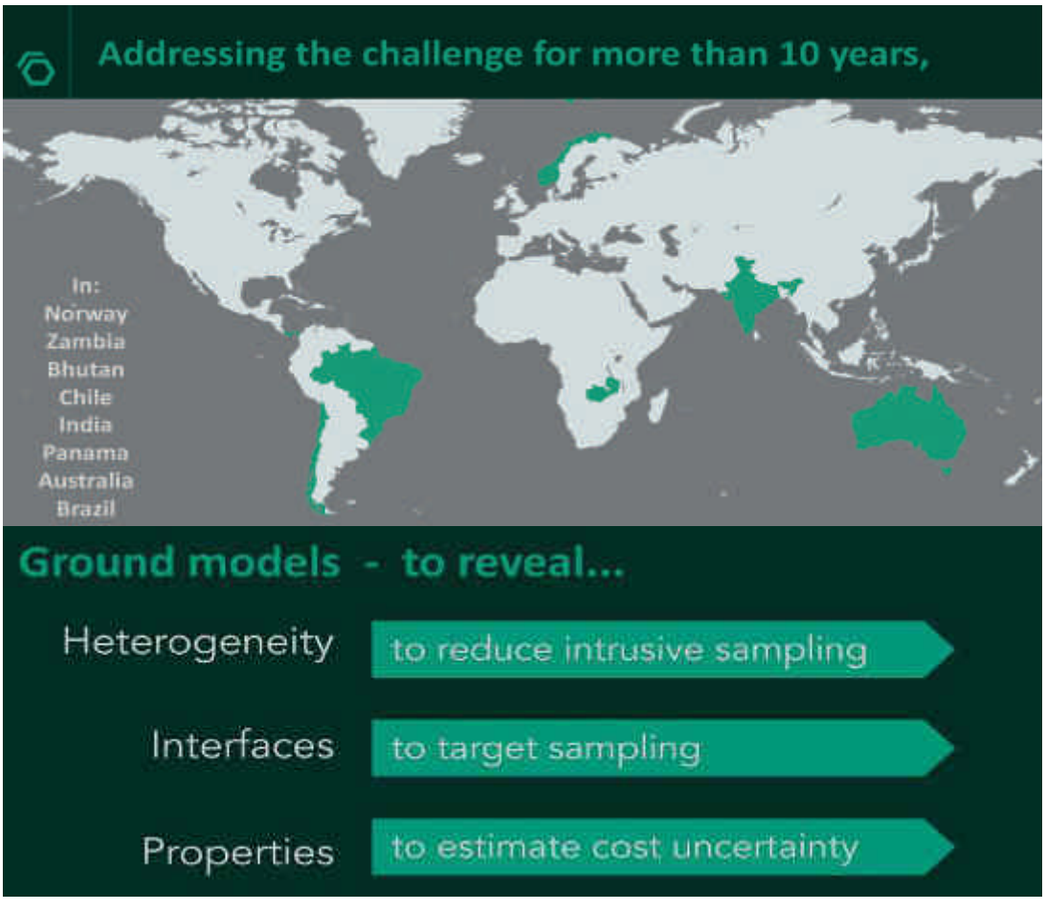
Key Points:

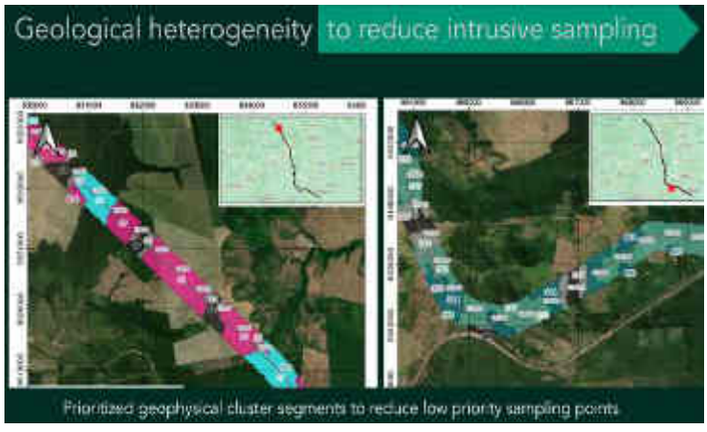
- **Addressing the 90% Challenge:** The company tackles the challenge of understanding the subsurface, where 90% of project risk and cost uncertainty lies.
- **Advanced Technology:** Emerald's technology utilizes machine learning to create detailed ground models, reducing the need for extensive and costly intrusive field sampling and surveys.

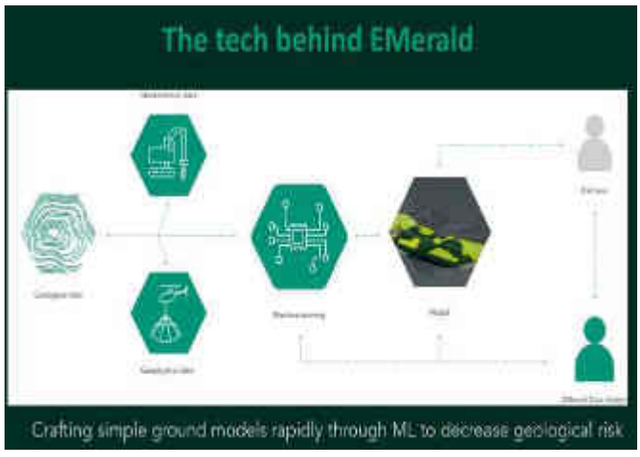
Benefits:

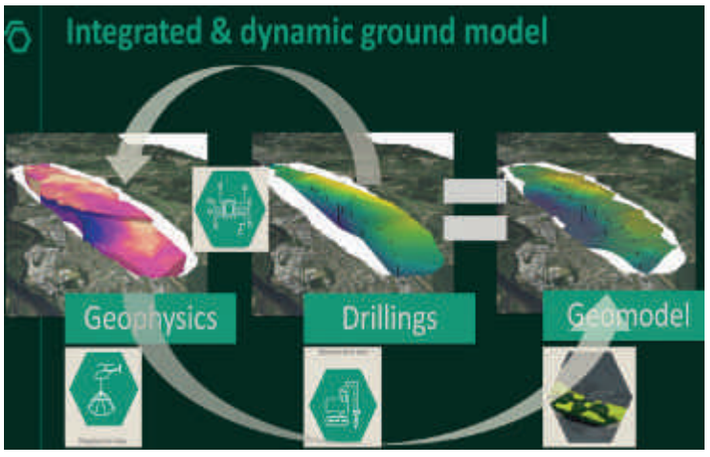
- Reduced project risk
- Lowered costs
- Accelerated project timelines
- Improved decision-making

- **Global Impact:** Emerald's solutions are applicable to various infrastructure projects worldwide, including mining, tunneling, and civil engineering.









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A Summary of Presentations and Insights

PAVING AWAY TO A CARBON NEUTRAL WORLD, RENKUBE

Mr. Balaji BL

SUMMARY

In essence, Renkube is paving the way for a future powered by clean, efficient, and innovative solar energy solutions.

COMPANY OVERVIEW:

Renkube is a pioneering company in the solar energy industry, focused on innovative solutions to maximize solar energy generation. Their core technology, Motion Free Optical Tracking (MFOT), allows solar panels to track the sun's movement without physical mechanisms, increasing energy output by up to 40%.

Key Innovations:

- **MFOT Technology:** This ground-breaking technology enables solar panels to capture more sunlight throughout the day, improving efficiency and reducing the need for large solar farms.
- **Solar Window Technology:** Renkube is exploring the integration of solar cells into windows, providing a unique solution for urban areas with limited rooftop space.
- **Agri-PV:** Combining agriculture and solar energy to optimize land use and increase crop yields.

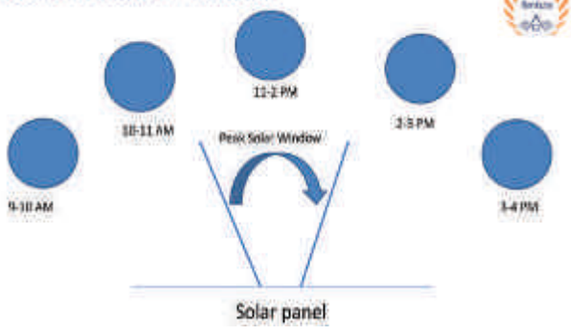
Benefits of Renkube's Solutions:

- **Increased Energy Generation:** Higher energy output from solar panels.
- **Reduced Land Use:** Efficient use of land for both solar power and agriculture.
- **Lower Maintenance Costs:** Reduced need for physical tracking mechanisms.
- **Enhanced Aesthetics:** Sleek and modern designs for seamless integration into buildings and landscapes.

Impact:

Renkube's innovative solutions have the potential to revolutionize the solar energy industry and contribute to a more sustainable future. By increasing energy efficiency and reducing reliance on fossil fuels, Renkube is helping to combat climate change and promote clean energy.

Solar Window - Limited



Current Solution

Physical Tracking

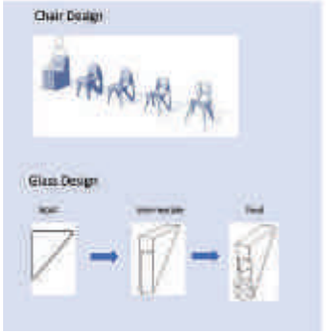
- Capital Intensive
- Maintenance
- Unsuitable in Rooftop

Proposed Solution

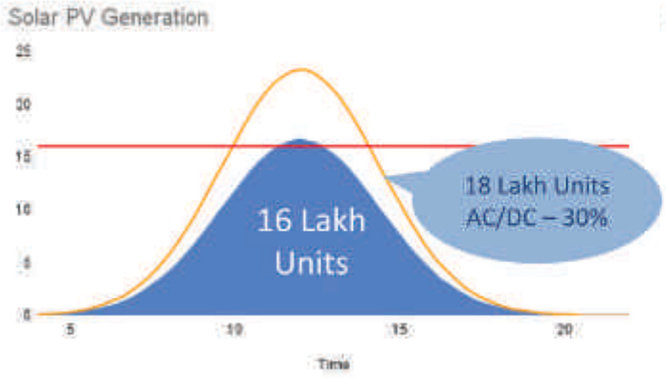
World's 1st Motion Free Optical Tracking

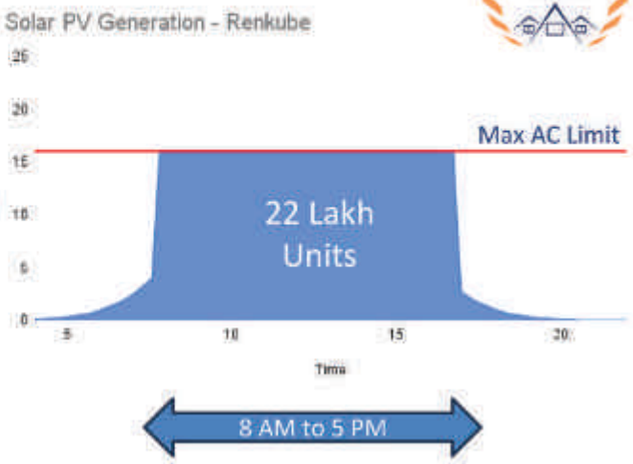
- +40% Energy Yield
- Avail 8 AM to 5 PM
- Solar Cell Agnostic

AI Based Solar Glass Design



Traditional Vs Renkube Comparison – 1 MW AC





A Summary of Presentations and Insights

EFFICIENT WASTEWATER TREATMENT, THE BPC ADVANTAGE COMPANY- BIOPETROCLEAN

Mr. Devendar Fonia

SUMMARY

By combining advanced technology, experienced professionals, and a commitment to sustainability, Bio Petro Clean India Pvt. Ltd. is shaping the future of wastewater treatment.

COMPANY OVERVIEW:

Bio Petro Clean India Pvt. Ltd. is a renowned company specializing in wastewater treatment solutions for various industries, including oil and gas, petrochemicals, pharmaceuticals, and more.

Key Technologies and Services:

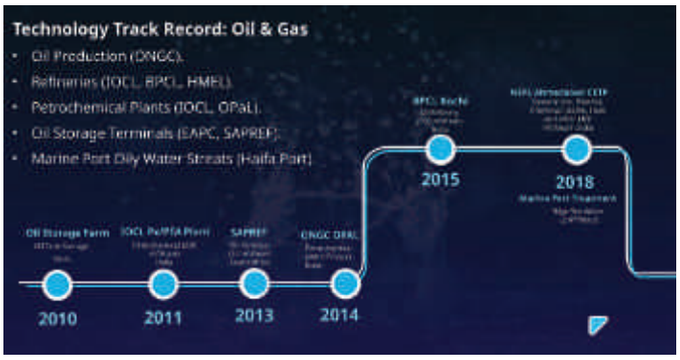
- **Advanced Biological Treatment:** Utilizing cutting-edge technologies like Advanced Catalytic Treatment (ACT) to efficiently remove organic pollutants.
- **Process Automation:** Implementing advanced automation systems to optimize operations, reduce costs, and improve efficiency.
- **Data-Driven Insights:** Leveraging data analytics and artificial intelligence to monitor and control wastewater treatment processes.
- **Customized Solutions:** Tailored solutions to meet the specific needs of each client, ensuring optimal performance and compliance with regulatory standards.

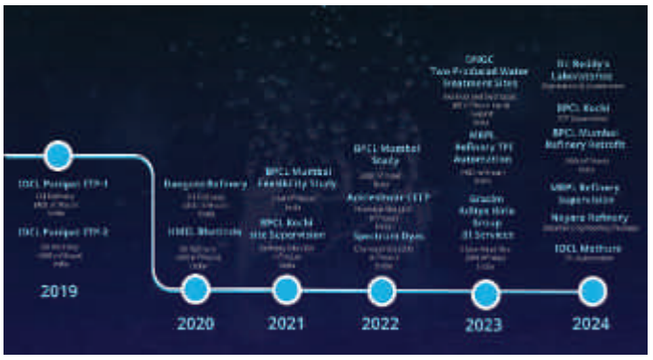
Benefits of BPC's Solutions:

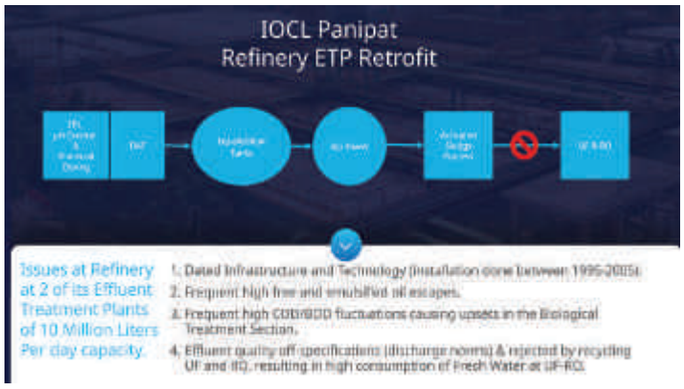
- **Improved Water Quality:** Enhanced effluent quality, meeting stringent discharge standards.
- **Reduced Operational Costs:** Optimized processes and reduced chemical usage.
- **Increased Plant Efficiency:** Improved plant performance and reduced downtime.
- **Environmental Sustainability:** Minimizing environmental impact and promoting sustainable practices.

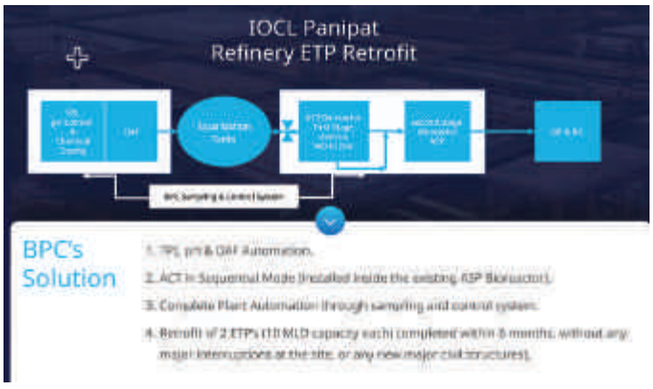
Successful Projects:

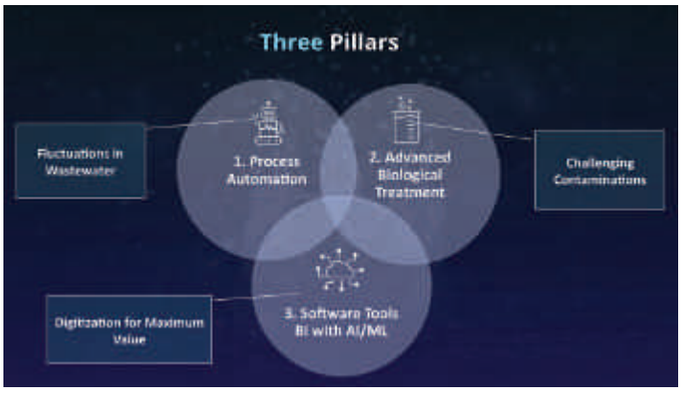
BPC has a strong track record of successful projects across India and internationally. Their expertise in handling complex wastewater challenges has led to significant improvements in water quality and operational efficiency for their clients.

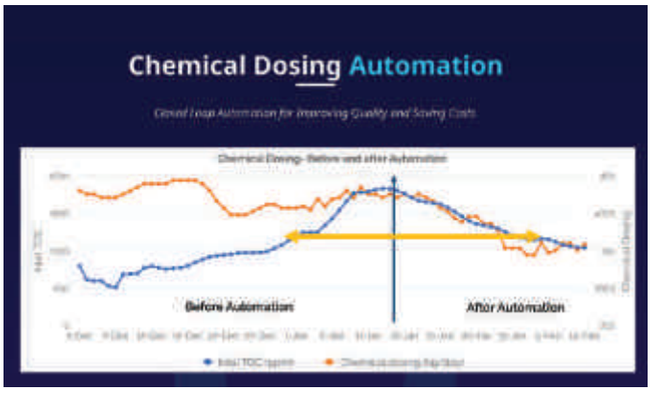


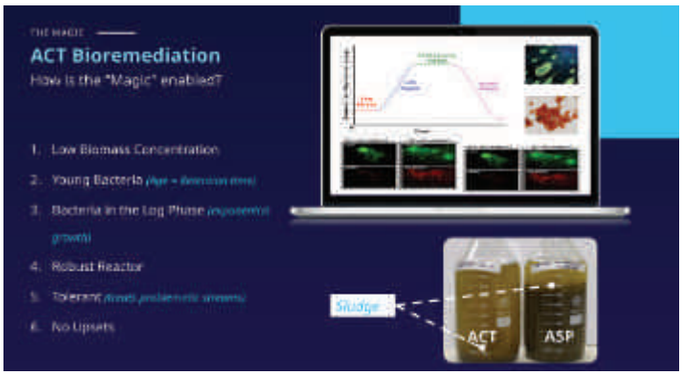


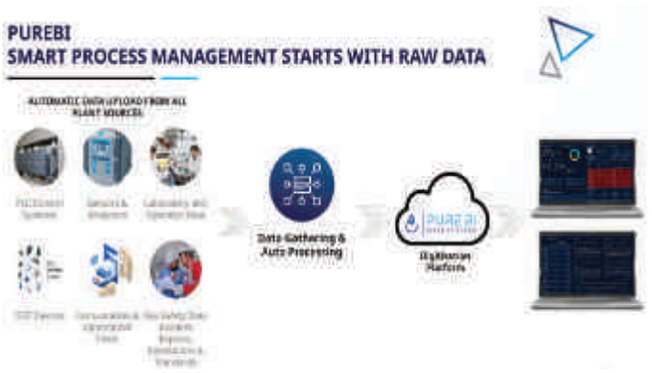












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A Summary of Presentations and Insights

CENTER PIVOT IRRIGATION, RENMAKCH

Mr. Milind Kayanade

SUMMARY

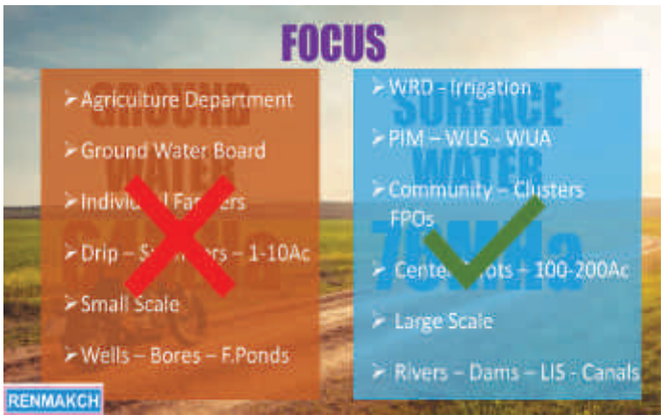
The implementation of center pivot irrigation systems has led to significant improvements in agricultural efficiency and productivity. These fully automated systems, operable via mobile devices, ensure equitable water distribution and achieve up to 90% irrigation efficiency, resulting in over 60% water savings. The adoption of this technology has increased crop yields by 50% to 280% and enhanced crop quality, thereby doubling farm incomes. Overall, this initiative contributes to farmer satisfaction, rural development, and national progress through sustainable and modern agricultural practices.

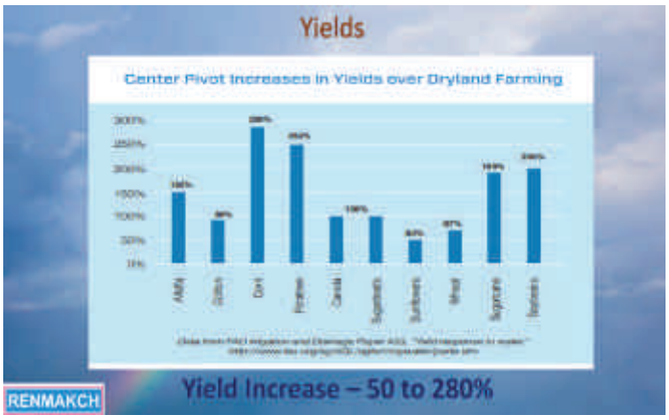
COMPANY OVERVIEW:

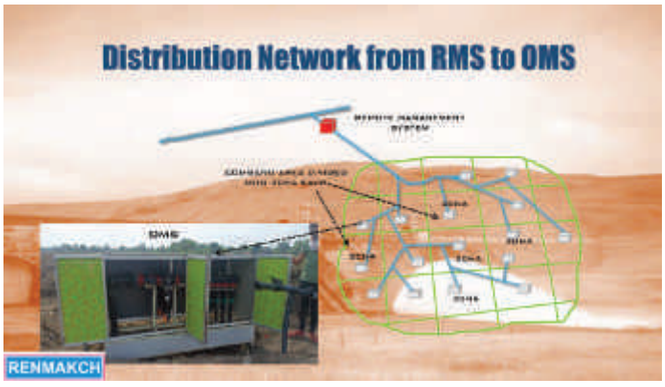
The presentation outlines an irrigation project involving two canals: the Right Bank Canal (30,000 Ha) and the Left Bank Canal (20,000 Ha). It highlights the operation of fully automatic center pivots that significantly increase crop yields by 50% to 280%, improve water efficiency by over 60%, and allow farmers to operate systems via mobile phones, ensuring equitable water distribution. The project aims to reduce labor intensity, enhance productivity, and ultimately lead to increased farm income and farmer satisfaction, contributing to a stronger agricultural sector.

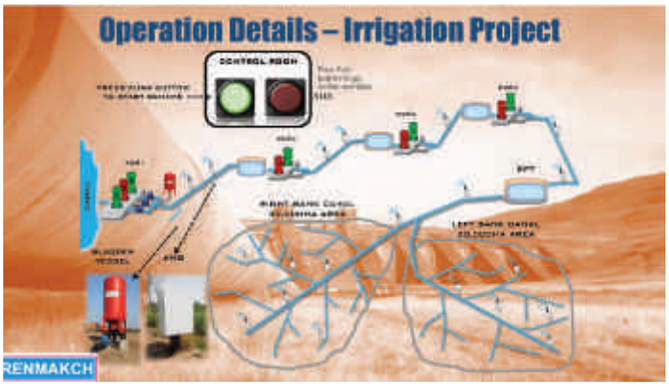
The command area is divided into sections of 30 hectares each, with various states managing different areas: Karnataka (50 Ha), MP WRD (30 Ha), MP NVDA (20 Ha), Odisha (20 Ha), Maharashtra (20 Ha), and UP (40 Ha). A Remote Management System (RMS) is in place to oversee operations, with a distribution network connecting it to the Operations Management System (OMS). This structure facilitates efficient management and distribution of water resources across the designated command areas.

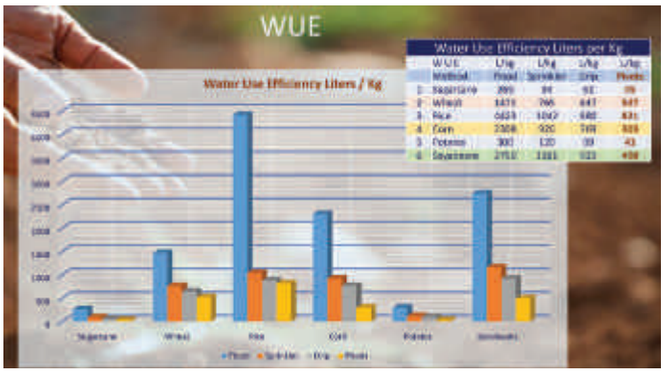
- **Negative Impact:** Inefficient irrigation leads to 40% efficiency and low productivity.
- **Water Resources:** Groundwater (64 MHa) and surface water (76 MHa) are critical.
- **Focus Areas:** Agriculture Department, individual farmers, micro-irrigation, and community clusters.
- **Irrigation Systems:** Drip, sprinklers, and center pivots show significant yield increases (50-280%).
- **Cost Analysis:** Center pivots are cost-effective with high water savings and efficiency.
- **Post-Project Benefits:** Automatic systems, equitable water distribution, increased yields, and improved farmer satisfaction.











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A Summary of Presentations and Insights

SPACE SI SATELLITE SYSTEMS AND SERVICES, SPACE SI (SLOVENIA)

Dr. Tomaz Rodic

COMPANY OVERVIEW:

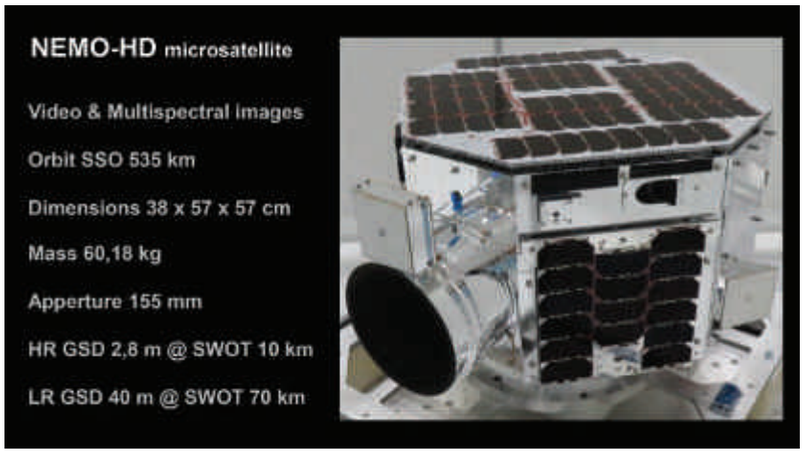
The provided information based on the presentation consists of various themes and topics that intersect art, science, technology, society, environment, government, and business. These themes reflect a multidisciplinary approach to addressing contemporary issues and fostering innovation. Below is a detailed summary of the key areas highlighted in the information.

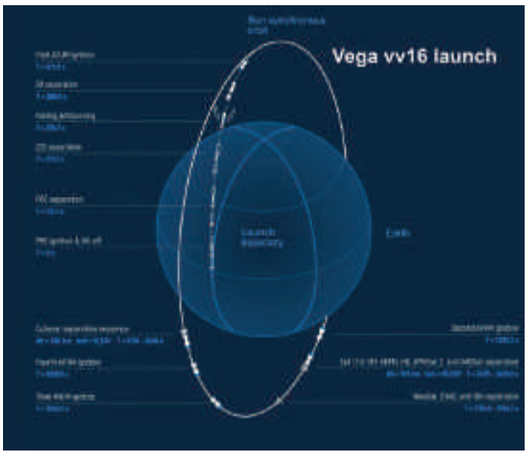
Society:

The concept of society encompasses the collective behavior, norms, and values of individuals within a community. It plays a crucial role in shaping individual identities and influencing social dynamics. The interplay between society and technology is particularly significant, as advancements in technology can lead to changes in social structures, communication methods, and cultural practices. The importance of empathy and understanding within society is emphasized, suggesting that art and science can serve as conduits for fostering social connections and addressing societal challenges.

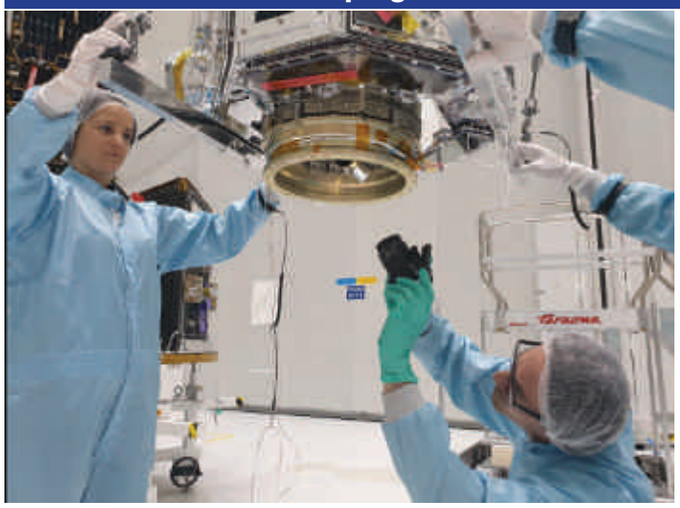
Environment:

Environmental issues are increasingly at the forefront of global discussions, particularly in the context of climate change, biodiversity loss, and sustainable development. The integration of technology in environmental





Nemo-HD Launch Campaign



monitoring and management is essential for addressing these challenges. Projects that utilize satellite technology for Earth observation can provide valuable data for understanding environmental changes and informing policy decisions. The emphasis on sustainability highlights the need for innovative solutions that balance economic growth with ecological preservation.

Government:

Government plays a pivotal role in regulating and facilitating initiatives that address societal and environmental challenges. Policies and regulations can either hinder or promote technological advancements and their applications in various fields. The collaboration between government entities, private sectors, and research institutions is crucial for developing effective strategies that leverage technology for public good. Transparency and accountability in governance are essential for building trust and ensuring that societal needs are met.

Arts:

The arts serve as a powerful medium for expression and communication, allowing individuals to explore complex themes and emotions. Artistic endeavors can raise awareness about societal and environmental issues, prompting discussions and inspiring action. The intersection of art with science and technology creates opportunities for innovative projects that engage audiences and foster a deeper understanding of contemporary challenges. Initiatives like “Eden transplanted” by Eva Petric

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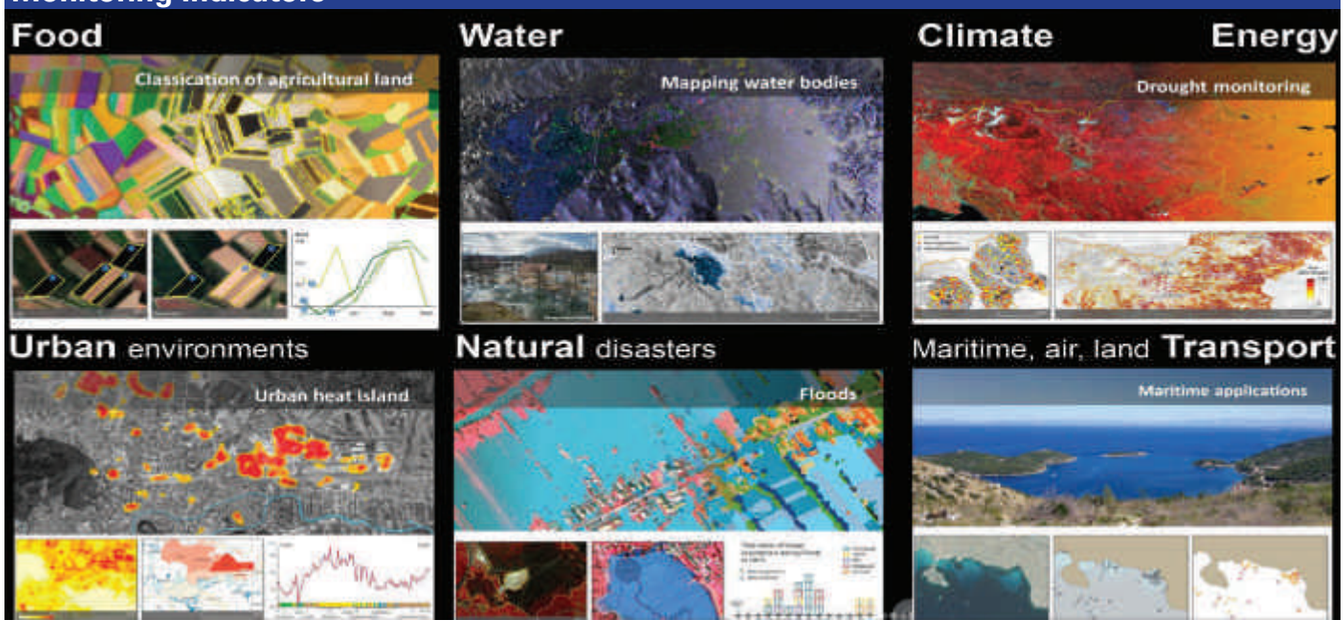
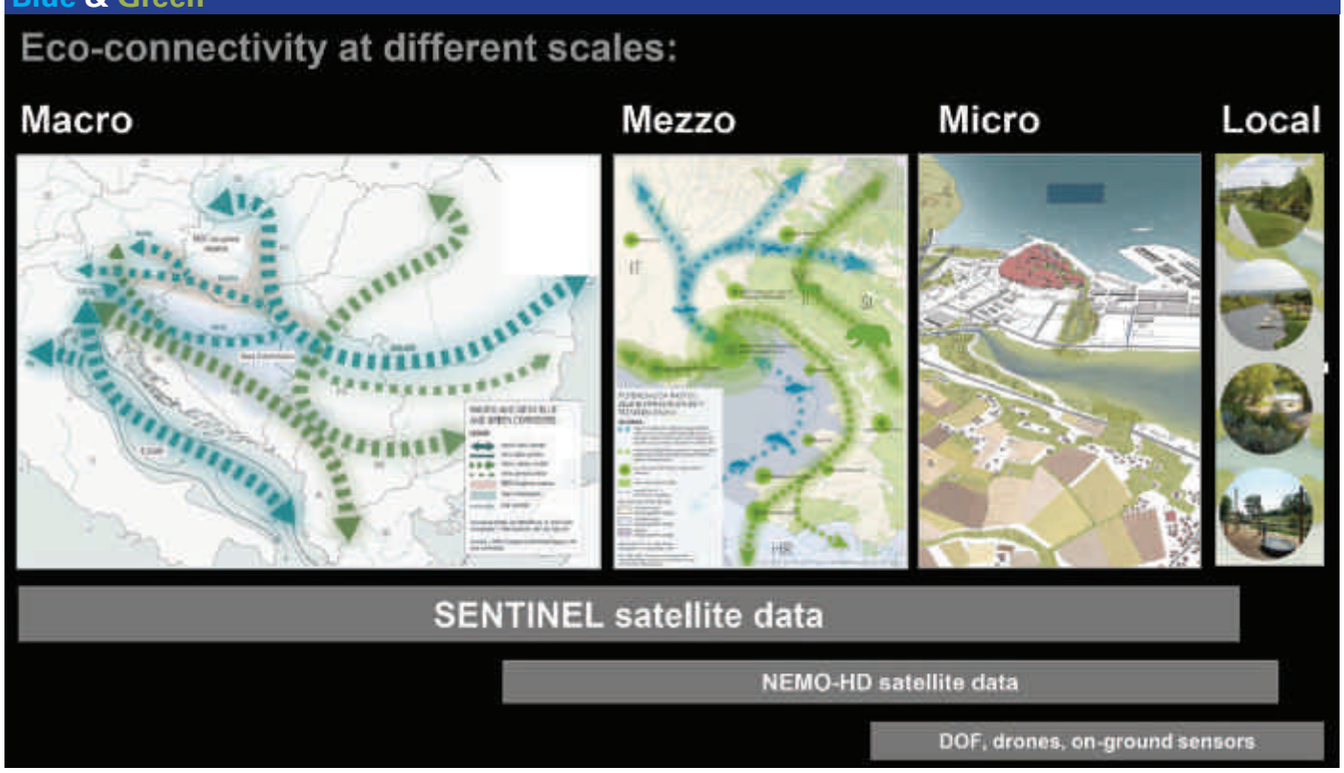
Monitoring Indicators



Nemo-RBS Challenges

Alpine, Danube & Lonian-Adriatic Region



exemplify how art can be used to address environmental concerns and promote sustainability.

Business:

The business sector is increasingly recognizing the importance of sustainability and social responsibility. Companies are adopting practices that prioritize environmental stewardship and ethical considerations in their operations. The integration of technology in business processes can enhance efficiency and drive innovation, leading to new products and services that meet societal needs. Collaboration between businesses and other sectors, such as academia and government, can lead to the development of solutions that benefit both the economy and the environment.

Technology:

Technology is a driving force behind many of the advancements in society, environment, and business. Innovations in fields such as artificial intelligence, data analytics, and satellite technology are transforming how we understand and address complex issues. The use of UHF receivers, transmitters, and sensors in projects like Nemo-RBS highlights the potential of technology to enhance data collection and analysis for environmental monitoring. However, the rapid pace of technological change also raises ethical considerations and challenges that must be addressed.

Science:

Science provides the foundation for understanding the natural world and developing solutions to pressing challenges. The integration of scientific research with artistic expression and technological innovation can lead to new insights and approaches. Earth observation science, for example, plays a critical role in monitoring environmental changes and informing policy decisions. Collaborative efforts between scientists, artists, and technologists can foster interdisciplinary approaches that enhance our understanding of complex systems and promote sustainable practices.

SUMMARY

The interconnectedness of society, environment, government, arts, business, technology, and science underscores the need for a holistic approach to addressing contemporary challenges. By fostering collaboration and innovation across these fields, we can develop solutions that promote sustainability, enhance social well-being, and drive economic growth. The emphasis on empathy, understanding, and creativity is essential for building a more resilient and equitable future. As we navigate the complexities of the modern world, the integration of these disciplines will be crucial for creating a better society for all.

A Summary of Presentations and Insights

GM-EVA HEAVY DUTY BACK RAKED SCREEN - GEO MILLER

Dr. Aman Maggo

SUMMARY

The GM – EVA Heavy Duty Back Raked Screen represents a significant advancement in the management of water quality and debris removal. By addressing the critical issue of pollution in the Ganga River, GM is not only enhancing the health of the river but also supporting the communities that depend on it. With a focus on innovation and sustainability, Geo Miller & Company continues to lead the way in environmental engineering and water treatment solutions.
For more information about GM and their products, visit [geomiller.com](http://www.geomiller.com).

COMPANY OVERVIEW:

Geo Miller & Company Pvt. Ltd. (GM) is a prominent player in the field of environmental engineering and water treatment solutions, with a legacy dating back to 1929. The company has consistently focused on addressing critical environmental challenges, particularly in water management. One of the pressing issues faced today is the increasing debris in rivers, notably the Ganga River, which poses significant risks to water quality and ecosystem health.

The Problem:

The Ganga River, a vital water source for millions, is facing severe pollution due to the accumulation of solid waste and debris. This not only disrupts the natural flow of the river but also leads to contamination, affecting both aquatic life and human populations relying on the river for drinking water and agriculture. The challenge of managing this debris is compounded by the river's dynamic environment, necessitating effective and sustainable solutions.

The Solution: GM – EVA Heavy Duty Back Raked Screen

To combat the issue of debris in the Ganga River, GM has developed the EVA Heavy Duty Back Raked Screen. This innovative solution is designed to efficiently remove solid waste from water bodies, ensuring cleaner water and a healthier ecosystem.

Key Features of the Back Raked Screen:

1. **Heavy-Duty Design:** The screen is engineered to withstand harsh environmental conditions and handle large volumes of debris, making it suitable for high-flow applications.
2. **Automatic Operation:** The Back Raked Screen operates automatically, reducing the need for manual intervention and ensuring continuous debris removal.
3. **Compact and Easy Installation:** Its design allows for straightforward installation in various settings, minimizing disruption to existing infrastructure.
4. **Versatility:** The screen can be adapted for use in different water bodies, including rivers, lakes, and treatment plants, making it a versatile solution for various environmental challenges.

Benefits of the Back Raked Screen:

- **Improved Water Quality:** By effectively removing debris, the screen helps maintain the natural flow of the river and reduces contamination, leading to improved water quality.
- **Ecosystem Protection:** The removal of solid waste supports the health of aquatic ecosystems, protecting fish and other wildlife that depend on clean water.
- **Sustainable Solution:** The automatic operation and durability of the screen contribute to a sustainable approach to water management, reducing the need for frequent maintenance and manual cleaning.
- **GM's Commitment to Environmental Solutions:** Geo Miller & Company is committed to providing comprehensive solutions that go beyond just equipment supply. The company emphasizes the importance of integrating technology with environmental stewardship, ensuring that their products contribute positively to the ecosystems they serve.

GM - EVA HEAVY DUTY BACK RAKED SCREEN

Eva screens are ready to use screens with lifting capacity of 2100 kg/time.

Compact Design.

Easy and quick installation on site.

The heavy duty screens are able to take out all solid material from size 30 X 30 mm to 1000 X 1090 mm such as waste garbage bags, furniture, wood, drums, tyres etc.

GM – EVA HEAVY DUTY BACK RAKED SCREEN

INSTALLATION IN OPEN CHANNELS

SCREENING MATERIAL AT IRLA NALA, MUMBAI

IRLA NALA, MUMBAI

TRACK C - CITIS 2024

December 04-06 2024

A Summary of Presentations and Insights

CAMBI THERMAL HYDROLYSIS PROCESS- ADVANCED ANAEROBIC DIGESTION OF SLUDGE AND FOOD WASTE IN A CIRCULAR ECONOMY

Dr. A Sahu, NWC & Cambi *(Joined in Hybrid Mode)*

COMPANY OVERVIEW:

Cambi's Thermal Hydrolysis Process (THP) is a cutting-edge technology designed to enhance the treatment of sewage sludge, transforming it into valuable renewable resources. This process not only improves biogas yield and biosolids quality but also significantly reduces the environmental impact associated with sludge disposal. With a global presence, Cambi has established itself as a leader in the field, providing sustainable solutions for wastewater treatment.

Performance Overview:

Cambi THP has demonstrated impressive performance metrics across various parameters. In a comparative analysis of conventional anaerobic digestion (AD) and THP, the following key performance indicators were noted:

- **Conversion Efficiency:** THP achieved a conversion efficiency of 59%, compared to 44% for conventional AD.
- **Gas Yield:** The gas yield from THP was significantly higher with 454 m^3/TDS, compared to 339 m^3/TDS for conventional AD. - Electrical Efficiency: THP exhibited a gross electrical efficiency of 20.6% and a net efficiency of 14.4%, outperforming conventional AD, which had efficiencies of 15.3% and 12.3%, respectively.
- **Electrical Output:** The electrical output from THP was 0.97 MWh/TDS, compared to 0.72 MWh/TDS for conventional AD. - Dewaterability: THP improved dewaterability, achieving a dry solids (DS) percentage of 32-45%, compared to 21-30% for conventional methods.

These metrics highlight the superior performance of Cambi THP in terms of energy recovery and sludge management.

Economic Impact:

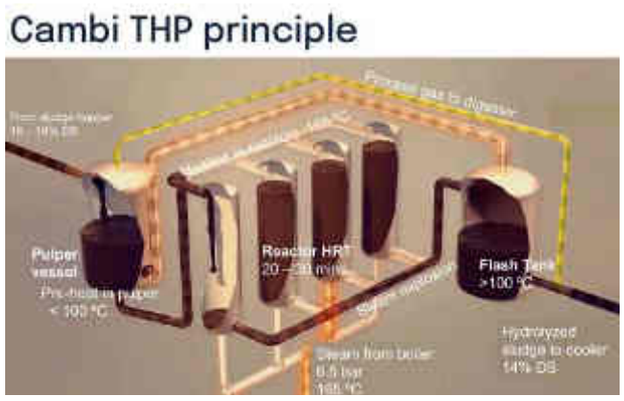
Cambi THP offers a highly attractive value proposition for municipalities and wastewater treatment facilities. The economic benefits include:

- **Biosolids Reduction:** The process can reduce biosolids by up to 50%, leading to lower disposal costs and reduced landfill usage.
- **Capital Expenditure (CAPEX) Savings:** Cambi THP can result in up to 35% savings in CAPEX compared to traditional sludge treatment methods.
- **Operational Expenditure (OPEX) Reductions:** The efficiency of THP leads to lower operational costs, making it a financially viable option for wastewater treatment facilities.

Environmental Impact:

Cambi THP is designed with sustainability in mind, contributing to a lower carbon footprint and supporting the circular economy. Key environmental benefits include:

- **Carbon Mitigation:** Cambi's technology helps mitigate approximately 1.2 million tonnes of CO_2



emissions annually, contributing to global climate goals.

- **High-Quality Biosolids:** The process produces high-quality biosolids that can be repurposed for agricultural use, reducing the need for chemical fertilizers.
- **Regulatory Compliance:** Cambi THP is robust to regulatory changes, ensuring that facilities can adapt to evolving environmental standards.

Technology and Scalability:

Cambi offers standardized and modular technology solutions that can be tailored to meet the needs of various customers. The technology is categorized into three project sizes:

1. **Small Projects (B2):** Designed for communities serving 50-250 thousand people equivalent, these systems are containerized and can be delivered on a single skid. Installation takes one week, with commissioning completed within two to three weeks.
2. **Medium to Large Projects (B4/B6):** Suitable for populations over 250 thousand, these systems are transported in modules and require three weeks for installation, with commissioning taking an additional two to three weeks.
3. **Extra Large Projects (B12):** For facilities serving over 1 million people equivalent, components are assembled on-site, with installation taking two to three months and commissioning lasting three to four weeks.

This modular approach allows Cambi to efficiently scale its solutions to fit the specific needs of different municipalities and treatment facilities.

SUMMARY

Cambi's Thermal Hydrolysis Process represents a significant advancement in sludge treatment technology, offering numerous benefits in terms of performance, economic viability, and environmental sustainability. With its proven track record and scalable solutions, Cambi THP is well-positioned to meet the growing demands of wastewater treatment facilities worldwide, contributing to a more sustainable future. The combination of enhanced biogas production, reduced biosolids, and lower operational costs makes Cambi THP an attractive option for municipalities looking to improve their sludge management practices while minimizing their environmental impact.

TRACK C - CITIS 2024

December 04-06 2024

A Summary of Presentations and Insights

AIWELL WATER: FLOODING IN THE STREETS

Mr. Johnson *(Joined in Hybrid Mode)*

COMPANY OVERVIEW:

The company is an award-winning inventor with 11 patents and is in the process of applying for a 12th patent. They have been actively engaged in research and development since 1992, focusing on innovative solutions for various engineering challenges.

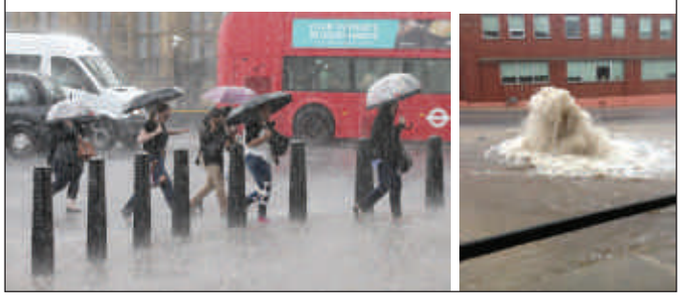
- **Addressing Climate Crisis:** The presentation emphasizes the importance of developing effective drainage systems to combat the climate crisis. The company aims to provide sustainable solutions that can adapt to changing environmental conditions.
- **Siphonic Drainage Systems:** The presentation highlights the effectiveness of siphonic drainage systems for roof drainage applications. These systems have been successfully implemented in Drammen since December 2017, showcasing their reliability and efficiency.
- **Current Projects:** The company is currently collaborating with Asker Municipality on drainage projects and is also involved in a new wastewater project in Kri, indicating their active role in improving local infrastructure.
- **Capacity Enhancements:** The presentation details the capacity improvements of new drainage pipes. For instance, a new pipe with an inner diameter of 1500 mm can handle flow rates of approximately 5 m^3/s at a height of 10 m, while a larger pipe with a diameter of 2000 mm can manage up to 10.3 m^3/s under the same conditions, demonstrating significant advancements in drainage capacity.

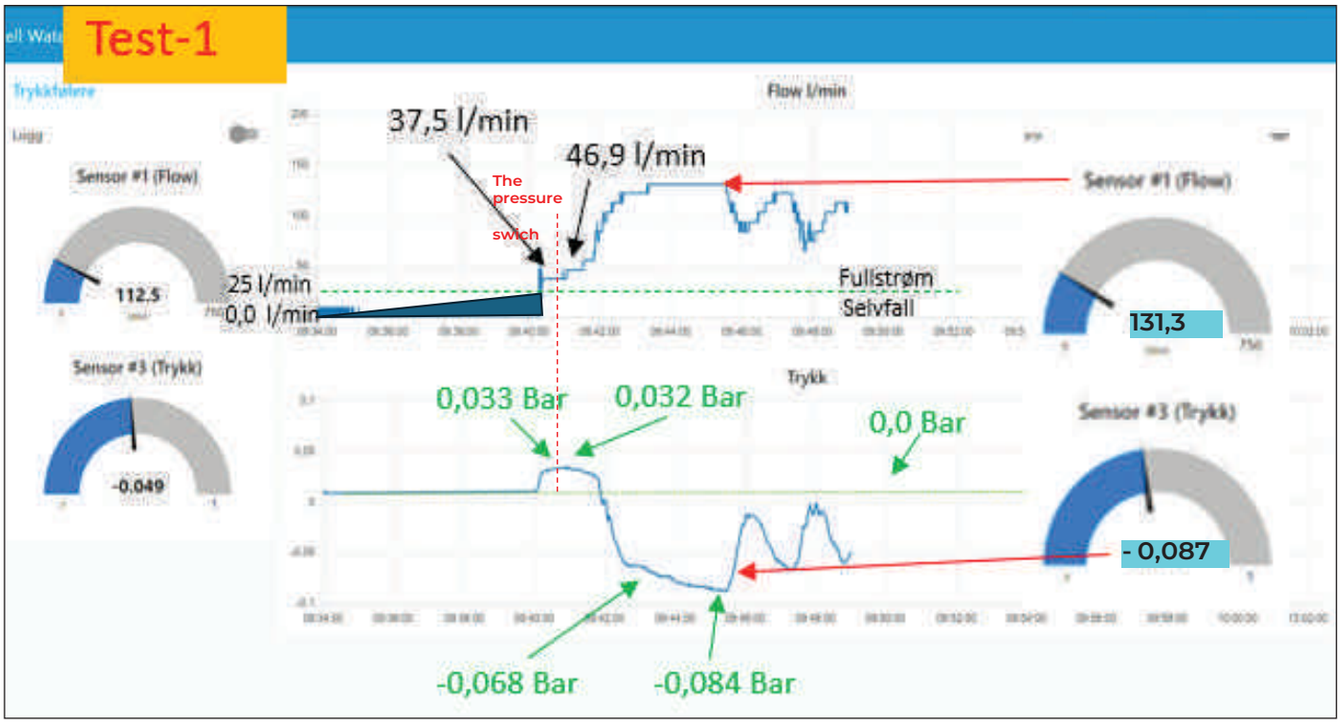
For further details, please visit [aiwellwater.no] (http://www.aiwellwater.no).

Who We Are

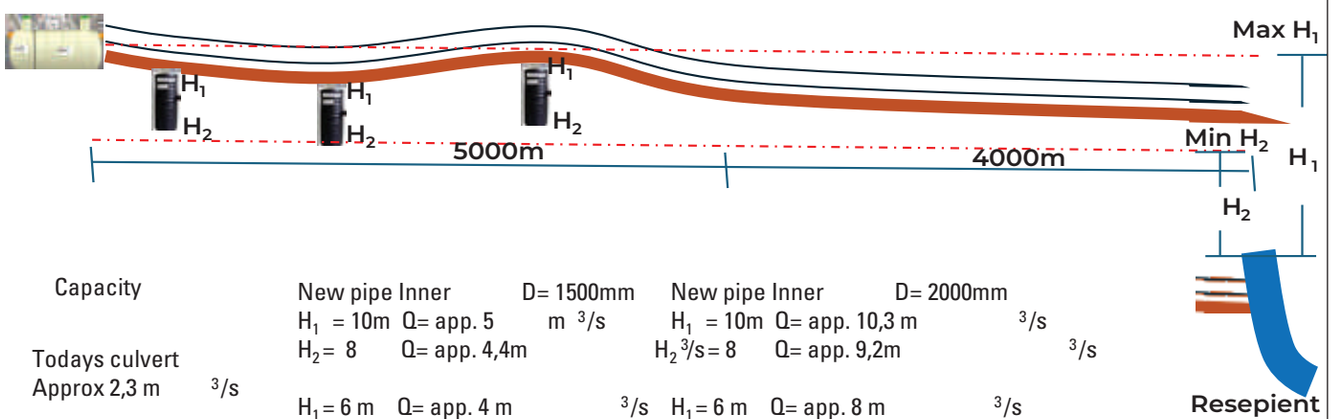
We are an inventing company with award-winning technology

We are dealing with a climate crisis





Principale of draining water when the pipe lays on the ground



Capacity

Todays culvert
Approx 2,3 m ^{3}/s

New pipe Inner D= 1500mm
H_1 = 10m Q= app. 5 m ^{3}/s
H_2 = 8 Q= app. 4,4m ^{3}/s

H_1 = 6 m Q= app. 4 m ^{3}/s
H_2 = 3,7 Q= app. 3 m ^{3}/s

New pipe Inner D= 2000mm
H_1 = 10m Q= app. 10,3 m ^{3}/s
H_2 ^{3}/s = 8 Q= app. 9,2m ^{3}/s

H_1 = 6 m Q= app. 8 m ^{3}/s
H_2 = 4 m Q= app. 6,5 m ^{3}/s

TRACK C - CITIS 2024

December 04-06 2024

A Summary of Presentations and Insights

COST EFFECTIVE, LOW ENERGY "ELECTROKOMPACT" STP FOR DECENTRALISED APPLICATION, ESTPL

Dr. Rajesh Biniwale

COMPANY OVERVIEW:

ElectroKompact, developed by Ecologique Science Technik (ESTPL), is an innovative sewage treatment plant (STP) technology designed to address the growing need for efficient and sustainable wastewater management solutions. This technology is particularly relevant in the context of increasing urbanization and the corresponding rise in wastewater generation. The presentation outlines the features, benefits, market potential, and operational aspects of ElectroKompact.

Technology Overview:

ElectroKompact is characterized by its low energy consumption and cost-effectiveness, making it an attractive option for decentralized sewage treatment. The technology is designed to be robust and easy to implement, with a focus on minimizing life cycle costs. Key features include:

- **Space Efficiency:** The system requires only 20-30 square meters for treating 100 kiloliters per day (kld) of wastewater, making it suitable for urban areas with limited space.
- **Automation and Control:** High levels of automation and process control ensure efficient operation and compliance with regulatory standards.
- **Regulatory Compliance:** The technology meets the norms set by the National Green Tribunal (NGT), Central Pollution Control

Board (CPCB), and State Pollution Control Boards (SPCB's).

- **Water Recovery:** ElectroKompact boasts a 97% water recovery rate, significantly reducing the volume of wastewater that needs to be treated and disposed of.
- **Sludge Generation:** The system produces negligible sludge, which is a critical advantage in reducing the environmental impact of wastewater treatment.

Cost Analysis:

A comparative analysis of ElectroKompact against traditional Moving Bed Biofilm Reactor (MBBR) technology reveals several cost advantages:

- **Capital Costs:** The capital cost for ElectroKompact is ₹185 lakhs, compared to ₹229 lakhs for MBBR.
- **Civil Costs:** Civil costs as a percentage of capital are higher for MBBR (64%) than for ElectroKompact (53%).
- **Operation and Maintenance (O&M) Costs:** 27.00 lakhs per MLD per year
- **Electricity Consumption:** ElectroKompact requires only 200 kWh per day, significantly lower than the 500-550 kWh required by MBBR.
- **Yearly Power Cost:** The annual power cost for ElectroKompact is ₹7.75 lakhs per MLD, compared to ₹13.2 lakhs for MBBR.
- **Annual Repair and Chemical Costs**: ElectroKompact also has lower annual repair costs (₹2.5 lakhs) and comparable chemical costs (₹3.2 lakhs).
- **Manpower Costs:** The manpower cost for ElectroKompact is ₹8.4 lakhs per annum, significantly lower than the ₹13.25 lakhs for MBBR.

A Summary of Presentations and Insights

SUMMARY

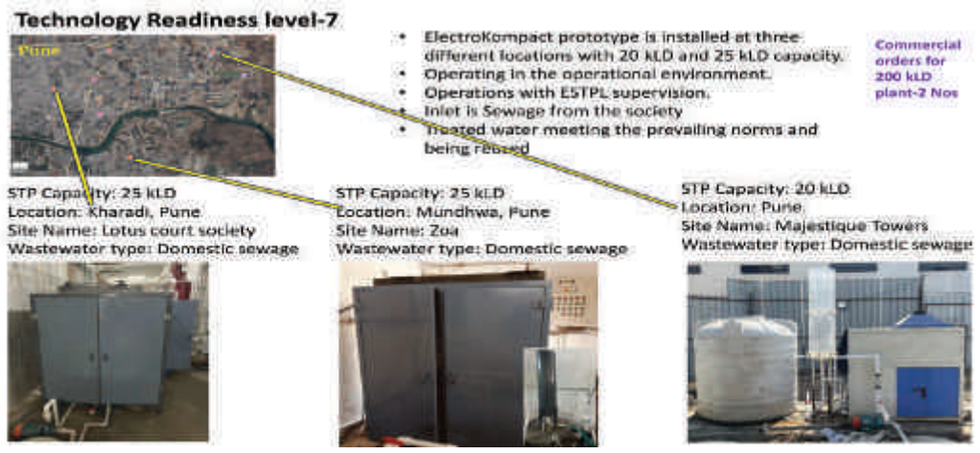
ElectroKompact represents a significant advancement in wastewater treatment technology, offering a robust, efficient, and cost-effective solution for decentralized sewage treatment. With its low energy requirements, high automation, and compliance with regulatory standards, it is well-suited to meet the challenges posed by urban wastewater management. The projected market growth and the specific focus on underserved regions further enhance the potential for ElectroKompact to establish a strong presence in the wastewater treatment sector.

Contact Information:
For further inquiries or collaboration opportunities, please contact Dr. Rajesh Biniwale at ESTPL.

Comparison for Typical Capacity of 1000 kLD

PARTICULARS	TECHNOLOGY WISE DETAILS & COSTS*	
	MBBR	ElectroKompact (ESTPL)
AREA REQ . SQMT/MLD	600	350
CAPITAL COST (Rs. in Lakhs)	229	185
CIVIL COST (% OF CAPITAL COST)	53	64
E&M WORK (%OF TOTAL CAPITAL COST)	47	36
OPERATION & MAINTANANCE COST		
Electricity Required Per Day (kWh)	500-550	200
YEARLY POWER COST (Lakhs/MLD)	13.2	7.75
ANNUAL REPAIR COST (Lakhs/MLD)	4.43	2.5
CHEMICAL COST (Lakhs/MLD)	3.3	3.2
MANPOWER COST (Lakhs/P.A.)	13.25	8.4
OTHER O&M (Sludge Disp, Analysis, Admin)	10.2	5.15
TOTAL O& M COST PER YEAR including other costs of O&M (Rs. in Lakhs)	44.20	27.0
CO_2 emissions kg/MLD	490-500	160-180

*These are approximate costs and depends on Site Specific Designs as well as local costs



- **Other O&M Costs:** Additional O&M costs for ElectroKompact are ₹5 lakhs, compared to ₹10.2 lakhs for MBBR.

Overall, ElectroKompact presents a more economical option for wastewater treatment, with lower capital and operational costs.

Market Analysis:

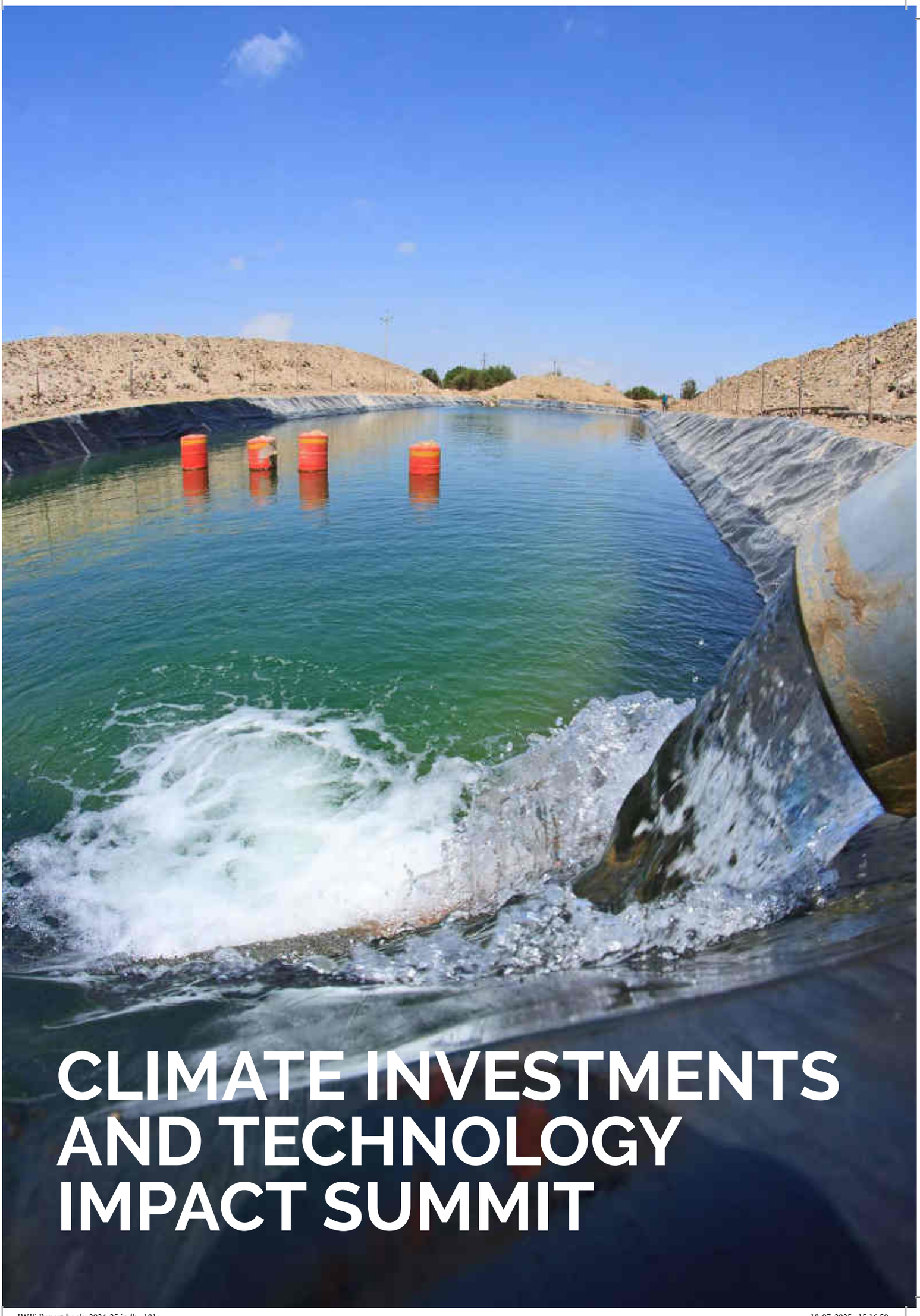
The total addressable market (TAM) is estimated to be between ₹42,400 to ₹74,000 crores, with decentralized systems potentially capturing 20% of this market.

Serviceable Addressable Market (SAM):

Focusing on specific regions such as Maharashtra, Madhya Pradesh, Chhattisgarh, and Andhra Pradesh, the serviceable addressable market is estimated to be around 5% of the TAM. This translates to a potential of 2000 societies, representing a market opportunity of ₹1000 crores.

Serviceable Obtainable Market (SOM):

ElectroKompact aims to capture a revenue target of ₹20 crores within the first two years of operation. The technology is positioned to serve small-scale plants for decentralized STPs, addressing a largely neglected segment of the market.



CLIMATE INVESTMENTS AND TECHNOLOGY IMPACT SUMMIT

Investing in Water

Day 2:
Thursday; December 5, 2024
0930 – 1100 hrs

Moderator: Mr. Sanmit Ahuja (Expert Member, cGanga, IIT Kanpur)
Mr. Bhaskar Dasgupta (ED-Finance, NMCG)

Lead Discussants:
Mr. Samir Shah (Peak Sustainability Ventures)
Mr. Uday Kelkar (NGS Engineering India Pvt. Ltd.)
Mr. Siddharth (Kishor Pumps & Pumping Systems)
Ms. Sinah Truffat (Analytics, Norway)
Ms. Suvarna Bhatt (HNB Engineers Pvt. Ltd.)
Prof. S.K. Singh (Expert in Wastewater Treatment & Environmental Economics)
Mr. Kevin Andrews (CFI Capital Corp / Finance International)
Mr. Rob Samson (Ceres Bio System)
Mr. Mithilesh Kumar Mishra (State Mission for Clean Ganga, Uttar Pradesh)
Mr. Vipul Singh (SMCG, Uttar Pradesh, PPP Expert)
Mr. Sanjit John (Water Connect / Water.org Global Initiative)
Mr. Ajit Savadi (JS Engineers, Special Projects & International Business)
Ms. Shanaya Tharoor (GMEX Group Zero13, Carbon Market Platform)
Ms. Minakshi Mittal (Project Manager, Haridwar, NMCG)
Ms. Shwetha Lokhande (Research Student, IIT Bombay)
Mr. Lokesh Vasist (Uttarakudi Irrigation Department)
Dr. Karthik Balasundaram (Visvesvaraya National Institute of Technology)
Mr. Kedar (French Development Agency, AFD)

BACKGROUND

FOAK Focus: Decentralised Waste-Water Usage

Rethinking Traditional Systems:
- Decentralised systems treat and reuse water closer to the point of consumption.
- Reduces dependence on centralised infrastructure and enhances sustainability.

Innovative Technologies:
- Utilises modular and scalable solutions such as bioreactors, membrane filtration, and constructed wetlands.
- Enables water recycling for agriculture, industry, and even potable uses in underserved areas.

Key Benefits:
- Minimises water waste by closing the local water loop.
- Improves water security and resource efficiency.

Challenges:
- Technical: Ensuring reliability and scalability of decentralised technologies.
- Regulatory: Outdated frameworks that create barriers to implementation.
- Community Acceptance: Building trust and public awareness for adoption.

Investment Needs:
- Technical support and innovation funding.
- Collaboration with policymakers to establish enabling regulations.
- Public outreach to ensure community buy-in.

NOAK Focus: Local Area Water Markets

Scaling Solutions:
- Establishes platforms for trading water rights, usage, and conservation efforts.
- Promotes efficient allocation of water resources based on local needs.

Economic Models:
- Monetises water efficiency and incentivises conservation.

- Encourages adoption of water-saving innovations like precision irrigation and smart metering.

Benefits:
- Aligns economic incentives with sustainable water management.
- Balances resource demands between agricultural, industrial, and municipal sectors.

Challenges:
- Equity: Ensuring fair and transparent allocation of water rights to avoid conflicts.
- Pricing: Balancing affordability with market efficiency to maintain accessibility.
- Resilience: Designing frameworks that withstand external shocks such as droughts or floods.

Investment Needs:
- Development of equitable and inclusive market frameworks.
- Transparent pricing mechanisms to ensure accessibility.
- Collaboration between investors and policymakers to create resilient systems.

DISCUSSION

This session on the economics and investments in the water sector, themed around "First of a Kind (FOAK) to Nth of a Kind (NOAK)," explored the challenges and strategies for scaling innovative water technologies and solutions. The discussion, chaired by Mr. Bhaskar Das Gupta (Executive Director of Finance, NMCG), brought together investors, technology providers, government representatives, and experts to identify pathways for commercializing and replicating successful pilot projects.

- **Mr. Sanmit Ahuja (Expert Member, cGanga, IIT Kanpur):**
  - Introduced the session's focus on the economics and investment's theme within the broader context of water's interplay with energy, land, agriculture, and other sectors.
  - Explained the "FOAK to NOAK" concept, emphasizing the unique challenges of implementing the first-of-a-kind projects and scaling them for widespread adoption.
  - Highlighted the need to address investor concerns about bankability and government requirements for precedence.
  - Proposed structuring the discussion into three parts: FOAK, NOAK, and potential projects.
  - Set the scene by outlining key challenges in the Indian water sector: rampant groundwater extraction, the stigma associated with recycled water, limited pipeline networks, and the persistent issue of polluted water bodies despite investments.
  - Suggested the creation of local area water markets and the aggregation of projects to attract larger investments.

- **Mr. Bhaskar Das Gupta (Executive Director of Finance, NMCG):**
  - Framed water as a scarce and increasingly valuable commodity, akin to

Investing in Water

gold or oil, presenting ample investment opportunities.

- Emphasized the all-encompassing nature of the water sector and the government's crucial role in investing in it, while also seeking private sector involvement.
- Expressed interest in learning from the experiences of participants in funding and scaling innovative water projects, particularly FOAK initiatives.

- **Mr. Samir Shah (Peak Sustainability Ventures):**

- Shared his firm's experience investing in the water space since 2008, focusing on scalable innovative technologies for drinking water, industrial water, and wastewater.
- Noted the lesser focus on water innovation compared to the net-zero and 1.5°C climate discussions.
- Highlighted an initiative to convert methane emissions from 100 wastewater treatment plants into bio-CNG, addressing a potent greenhouse gas.
- Mentioned investments in electro-coagulation technology for wastewater recycling, with Indian-made hardware being exported.
- Stressed the importance of water quality (arsenic removal) alongside quantity and pointed to a successful arsenic removal project using Indian technology.
- Announced "Blue Seeds," an initiative to promote water startups, recognizing their underrepresentation.

- **Mr. Uday Kelkar (NGS Engineering India Pvt. Ltd.):**

- Shared his company's 22 years of experience in India, working on NMCG and other funded water projects.
- Emphasized the need for realistic timelines in government projects and highlighted issues with design parameters (BOD, COD, TSS) often not reflecting actual influent water quality.
- Pointed out the lack of consideration for consultant expertise and the tendency to solely focus on the lowest bidder (L1).
- Advocated for the importance of operator certification and the need for continuous, geometric mean-based water quality monitoring.

- Stressed the potential for cost recovery through reuse of treated water and the need for public awareness campaigns for direct potable reuse (DPR) and indirect potable reuse (IPR).
- Highlighted the importance of data-driven decision-making, including flow rate and water quality databases.
- Criticized unrealistic energy generation guarantees by contractors in bids.

- **Ms. Suvarna Bhatt (HNB Engineers Private Limited):**
- Shared her company's experience as the first concessionaire for an NMCG PPP project in Haridwar, a "game changer" in wastewater.
- Highlighted the potential for private investment in the sector but noted initial financing difficulties for FOAK projects.
- Observed consistently excellent outlet parameters in their Haridwar plant, often operating above design capacity.
- Stressed the need for policy interventions, including regular reviews and budget allocation to address increasing flows and new pollution sources.
- Advocated for an integrated approach between government and private sectors, with a "one city-one operator" model and continuous review.
- Expressed regret over the lack of reuse

Investing in Water

provisions for high-quality treated water discharged into drains.
- Called for policy mandates on water reuse and highlighted the need for central monitoring of project life cycles and costs.

- **Dr. Karthik Balasundaram (VNIT Nagpur):**
- Emphasized the lack of a market for treated water as a primary obstacle to reuse.
- Suggested creating a market through mandates or building public trust, drawing parallels with the electric vehicle market.
- Shared an anecdote about reluctance to use treated water for car washing in a posh residential complex despite good quality.
- Argued that a market for water, driven by buyback models or revenue generation, would incentivize better management.

- **Mr. Mudit Jain (Participant):**
- Shared experience financing water projects under the HAM model for Namami Gange, where a business model is assigned.
- Agreed on the limited use of treated sewage water and the disparity between municipal water prices and the cost of reusable treated water.
- Noted increasing industry adoption of ZLD due to NGT penalties.
- Stressed the need for a business model, driven by either incentives or mandates, to create a market for treated water.



- **Mr. Sanjit John (Water Connect):**
  - Pointed out the fragmented approach in the water sector and the need for a holistic view for climate-resilient and impact funds.
  - Emphasized policy enforcement and customizing solutions to local and regional problems rather than simply copy-pasting technologies.
- **Mr. Prashant Nutula (Participant):**
  - Suggested focusing on micro-markets for water reuse.
  - Advocated for a PPP model in the water sector, like the electrical field.
  - Highlighted the need for a business model for funding nature and pricing in negative externalities.
- **Mr. Nishant (Walters Green):**
  - Focused on the industrial use of water, suggesting charging industries (like coal projects) more for freshwater to incentivize the use of conserved water.
  - Stressed the need for state government buy-in and ensuring industry competitiveness in export markets.
- **Dr. Karthik Balasundaram - Follow-up (VNIT Nagpur):**

GIST

This session focused on overcoming the "valley of death" for innovative water technologies by exploring economic and investment strategies to scale them from "First of a Kind" (FOAK) to widespread "Nth of a Kind" (NOAK) adoption. The discussion highlighted the need to create viable water markets, attract investment by demonstrating bankability, and address the challenges of transitioning from pilot projects to commercial success. Key barriers identified included the lack of clear market signals, fragmented approaches, regulatory hurdles, and the need for capacity building. The panel explored solutions such as creating local water markets, aggregating projects for investment, implementing mandates for water reuse, pricing water to reflect its true value, and fostering collaboration among innovators, investors, government, and industry to accelerate the deployment of impactful water technologies. The session emphasized the importance of identifying buyers, establishing clear economic models, and building trust in recycled water to unlock the potential of water as an investable asset.

KEY TAKE AWAY POINTS

- **Bridging the FOAK to NOAK Gap:** Scaling innovative water technologies requires strategic economic and investment approaches to overcome the "valley of death."
- **Creating Water Markets is Essential:** Identifying and securing buyers for treated water and establishing appropriate pricing mechanisms are crucial for attracting investment and driving adoption. Mandates and incentives can play a role.
- **Demonstrating Bankability and Investability:** Investors need clear evidence of a technology's commercial viability and potential for return on investment.
- **Addressing Market Fragmentation:** A more holistic and integrated approach across the water sector is needed to create larger, more attractive investment opportunities.
- **The Role of Government and Policy:** Clear and supportive policies on water reuse, pricing, and enforcement are vital for creating demand and de-risking investments.
- **Importance of Economic Models:** Viable business models, including full cost recovery and value-based pricing, are necessary for the long-term sustainability of water projects.
- **Building Trust in Recycled Water:** Public awareness campaigns and successful pilot projects are essential to overcome the stigma associated with recycled water and create a market for its reuse.
- **Focus on Local Solutions and Micro-Markets:** Developing localized water markets and tailoring solutions to specific regional needs can create immediate opportunities for technology deployment.
- **Aggregation of Projects:** Bundling smaller projects into larger tenders can create the scale needed to attract significant institutional investment.
- **Capacity Building and Standardization:** Investing in training and certifying operators and establishing clear technical standards are crucial for ensuring the reliable and efficient operation of water infrastructure.

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- Reiterated the importance of mandates in creating a market for treated water to overcome the lack of buyers.

- **Mr. Sanmit Ahuja - Concluding Remarks (Expert Member, cGanga, IIT Kanpur):**
- Affirmed the existence of water markets and the need to identify and support FOAK projects in each segment.
- Announced the development of a digital platform for creating water markets and managing water balance.
- Highlighted the need for licensing frameworks for bulk water consumers.
- Stressed the importance of HR capacity building and operator certification.
- Acknowledged the complex issue of funding nature and the need to price in negative externalities.
- Emphasized the importance of finding buyers to drive market development.
- Announced the upcoming release of a detailed paper summarizing the discussions and invited further contributions.

Investing in Energy

Day 2:
Thursday; December 5, 2024
1130 – 1300 hrs

Moderator:
Mr. Sanmit Ahuja
(Expert Member, cGanga, IIT Kanpur)
Mr. Bhaskar Dasgupta
(ED-Finance, NMCG)
Mrs. Sangita M. Kasture
(Scientist G, Ministry of New and Renewable Energy)

Lead Discussants:
Mr. K S Popli (World Bio Gas Association)
Mr. Abhishek Mundhra (Geo Miller)
Mr. Nishant Adani (Walter Screen Funding)
Mr. Sumit Milan (PRESPL)
Mr. Saurabh Kumar (Keystone Energy Systems)
Mr. Ankur Jha (Journalist, Department of Water Resources)
Mr. Prashant Nautila (Deloitte)
Ms. Aarti (World Bio Gas Association)
Mr. Anup Parashar (Tata Capital)
Mr. Salim Shaikh (Eko Mumbai)
Mr. Kedar Dahiya (French Development Agency)
Mr. Aditya Sharma (Bison Energy)
Mr. Rohit Vadhera (AUM Energy)
Mr. Rob Samson (Ceres Biosystems)
Mr. Kevin Andrews (Ceres Biosystems / Core Financing International)
Mr. Subhash Kumar (Indian Sugar Mills Association / Real Dynamics)
Mr. Saurav Kabra (COCO Networks)
Mr. Sameer Shah (Peak Sustainability Ventures)
Mr. Sanjit John (Water Connect)
Ms. Shanaya Tharoor (GMEX Group Zero13)
Ms. Sakshi Jha (cGodavari Team, IIT Hyderabad)
Ms. Sangamitra (Deloitte)
Mr. Lokesh Kumar Vasisth (UP Education Department)
Ms. Meenakshi Madhu (Project Manager, Haridwar)
Mr. Bharu Prithav Singh (Bhavani Power, Small Hydro)
Ms. Angela Thomas (Socrates Foundation)
Mr. Najiba (Bharathan Systems)
Mr. Parag Shide (Eco Environment)
Mr. Samir Khan (Innovative Water Technologies)
Mr. Girish Kumar (Resurgent India)
Mr. Nitish Shrivastav (Circular Economy Alliance of Australia)
Mr. Rishi (Deloitte)
Ms. Lynda (Intern, Bharatia)
Mr. Lincoln Tapre (Engineer from Zimbabwe)

BACKGROUND

FOAK Focus: Decentralised Bio-Energy Systems

Objective:

- Build the technical capability and operational capacity to establish decentralised biofuels and biogas systems across diverse regions.
- Address energy needs at local levels while promoting sustainability and energy independence.

Key Features of Decentralised Systems:

- Utilise locally available biomass and organic waste to generate biofuels and biogas.
- Reduce reliance on fossil fuels while minimising waste and greenhouse gas emissions.
- Provide cost-effective energy solutions for rural and peri-urban areas.

Technological Approaches:

- Use of anaerobic digestion, pyrolysis, and gasification for efficient biogas and biofuel production.
- Modular and scalable systems tailored to the specific needs of local communities.

Implementation Challenges:

- Need for skilled manpower and technical know-how to operate and maintain these systems.
- Limited access to initial funding for pilot projects.
- Lack of standardised regulations for decentralised energy systems.

Case Studies:

- Examples from India, where rural communities have successfully implemented decentralised biogas plants for cooking fuel and electricity.
- Projects in Sub-Saharan Africa showcasing biofuel solutions for off-grid energy access.
- Pilot initiatives in Europe and the Americas integrating bio-energy systems into existing energy grids.

Benefits:

- Enhanced energy access for underserved populations.

The major objectives of NOAK are to develop financial and operational models to scale biogas and biofuels from pilot projects to mainstream energy solutions and establish market pathways for new-age fuels such as Compressed Biogas (CBG), Sustainable Aviation Fuels (SAFs), and methanol.
Aviation Fuels (SAFs), and methanol.

- Job creation in rural areas through the setup and maintenance of bio-energy facilities.
- Contribution to national and local-level energy security.

NOAK Focus: Pathways to Scale Up

Objective:

- Develop financial and operational models to scale biogas and biofuels from pilot projects to mainstream energy solutions.
- Establish market pathways for new-age fuels such as Compressed Biogas (CBG), Sustainable Aviation Fuels (SAFs), and methanol.

Scaling Challenges:

- High upfront costs for infrastructure development.
- Market readiness for emerging biofuels like CBG and SAFs remains limited.
- Policy and regulatory frameworks often do not incentivise large-scale adoption.

Financial Models for Scaling:

- Public-Private Partnerships (PPPs) to share risks and costs between governments and private entities.
- Green bonds and climate finance mechanisms to mobilise investments.
- Revenue-sharing models with stakeholders, including farmers, industries, and local communities.

Pathways to CBG Markets:

- Establish local supply chains for feedstock such as agricultural residues and municipal waste.
- Develop robust distribution networks to deliver CBG to industrial and domestic users.
- Collaborate with natural gas companies to integrate CBG into existing pipelines.

Pathways to SAFs:

- Invest in research and development to lower production costs and improve SAF efficiency.

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- Partner with airlines to establish offtake agreements and create demand for SAFs.
- Advocate for policy incentives, such as tax benefits or blending mandates for SAFs.

Pathways to Methanol Markets:

- Promote methanol as a low-carbon alternative in industrial applications and transportation.
- Develop production facilities that leverage carbon capture technologies for methanol synthesis.
- Foster international trade partnerships to build global methanol supply chains.

Benefits of Scaling:

- Significant reductions in greenhouse gas emissions through clean energy transitions.
- Enhanced energy security and diversification of energy sources.
- Creation of vibrant markets for green fuels, boosting economic growth and sustainability.

DISCUSSION

This session at the Climate Investments and Technology Impact Summit (CITIS), co-located with the India Water Impact Summit (IWIS), focused on the economic and investment strategies required to scale up biogas and biofuel technologies in India, moving from "First of a Kind" (FOAK) pilot projects to widespread "Nth of a Kind" (NOAK) commercialization. The discussion aimed to bridge the gap between technological potential and realizable, investable markets in the bioenergy sector.

Key Themes and Discussion Points:

- **Interplay of Water and Energy:** The session's placement within CITIS underscored the deep nexus between water and energy, recognizing that investments in one often have significant implications for the other.

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- **FOAK to NOAK Framework:** The central challenge is transitioning novel bioenergy solutions from initial, often unique, implementations (FOAK) to mass-market deployment (NOAK). This requires addressing technological, policy, engineering, social, legal, governance, financial, and economic aspects to establish precedents for scaling.

Overview from Officials of MNRE & NMCG:

- **Ms. Sangeeta Kasturi (MNRE):** Provided an overview of India's ambitious renewable energy targets (500 GW by 2030), highlighting the significant potential and existing policies for bioenergy (biofuel blending mandate, SATAT scheme for CBG). She emphasized the need for recommendations on infrastructure and investments for surplus biomass management and energy generation, aligning with India's net-zero target.

- **Mr. Bhaskar Das Gupta (NMCG):** Framed investing in energy as largely investing in renewables, with India as a leader. He pointed to the potential of sustainable aviation fuel, compressed biogas (CBG), and the methanol economy. He also highlighted the synergy between water and energy, citing solar panels over canals as an example, and expressed interest in hearing investment strategies for these areas.

- **Round Table Introductions:** Participants from various sectors (biogas developers, biofuel companies, financiers, technology providers, government agencies, researchers) briefly introduced themselves and their interests.

- **Biogas Economy in India: Gaps and Solutions:**

- **Mr. Subhash Kumar (Indian Sugar Mills Association):** Highlighted that CBG plants are not a new concept but haven't scaled due to unaddressed issues. He emphasized India's significant bio-residue potential but noted a lack of investment in technology, standardization, manpower, and pricing the externalities of current waste handling. He welcomed government initiatives but stressed the need for a national institutional framework for aggregation, storage, standardization, and financial support, learning from global successes.

- **Mr. K S Popli (World Bio Gas Association):** Agreed on the limited number of large-scale biogas plants despite the potential. He attributed past failures to a lack of bankable

The central challenge is transitioning novel bioenergy solutions from initial, often unique, implementations (FOAK) to mass-market deployment (NOAK). This requires addressing technological, policy, engineering, social, legal, governance, financial, and economic aspects to establish precedents for scaling.

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revenue streams and a uniform methodology for digestate management. He expressed optimism for the sector's growth, comparing its current stage to solar's earlier days.

- **Ms. Sangeeta Kasturi (MNRE):** Acknowledged multiple challenges but highlighted government efforts through unified portals (Govardhan), market development assistance, and the need for solutions for managing the large volumes of digestate. She emphasized the importance of feedstock supply chain, cost, and technology agnosticism.
- **Sludge Management Nexus:** The discussion highlighted the parallel challenges of sludge management in the water sector and digestate management in the biogas sector, emphasizing the need for standardization and market linkages. The potential of sludge as a soil conditioner and the role of the fertilizer ministry were discussed.
- **Biochar Potential:** Converting some biomass into biochar during the digestion stage was suggested as a way to enhance the value of the digestate as a soil amendment.
- **Cost Viability and Bankability:** The fundamental driver for scaling is economic viability and bankability. The current low IRRs of biogas projects without considering digestate value or carbon credits were noted.
- **Technology and Integration:** The need for efficient and integrated technologies, including pre-digestion and gas purification, was emphasized as crucial for improving plant performance and meeting grid standards.
- **Policy and Mandates:** Blending mandates (like ethanol blending) and potential mandates for biogas injection into the gas grid were discussed as policy levers. The government's role in de-risking FOAK projects was highlighted.
- **Biofuels: Scaling Challenges:** Similar

challenges of feedstock availability, pricing, storage, and the FOAK barrier were noted for biofuels (second-generation biofuels, SAF). The need for risk-sharing mechanisms and clear policy roadmaps for large-scale biofuel investments was emphasized.

- **The "Chicken and Egg" Problem:** The lack of a clear market (offtake agreements) hinders investment, while a lack of operational plants hinders market development.
- **Financial Models:** Innovative financial models, potentially involving commodity funds, storage infrastructure trusts (InviTs), and dedicated funding for energy systems, were proposed to address the financing gap.
- **Importance of Standardization:** Standardization of feedstock quality, gas purification levels, digestate characteristics, and project certification processes are crucial for building investor confidence and facilitating scaling.
- **Energy Security as a Driver:** The overarching goal of energy security, coupled with decarbonization, should drive the bioenergy agenda.

GIST

The session highlighted the significant potential of biogas and biofuels in India's energy transition but underscored the substantial challenges in scaling these technologies beyond pilot projects. Key obstacles include feedstock management, technological gaps (especially in gas purification), financial viability, and the lack of well-defined markets and policy support. The discussion emphasized the need for integrated solutions, innovative financial models, robust policy frameworks, standardization, and a focus on creating demand to attract investment and achieve widespread commercialization, ultimately contributing to energy security and decarbonization goals.

KEY TAKE AWAY POINTS

- **Scaling Bioenergy Requires a Holistic Approach:** Technology alone is insufficient; economic viability, policy support, market creation, and infrastructure development are equally critical.
- **Feedstock Management is Paramount:** Ensuring a consistent and affordable feedstock supply chain is a fundamental challenge that needs innovative solutions in aggregation, storage, and pricing.
- **Technology Gaps Need Addressing:** Improving gas purification technologies for biogas and advancing second-generation biofuel technologies are crucial for wider adoption and grid integration.
- **Financial Innovation is Necessary:** Attracting investment requires de-risking projects through innovative financial models and clear revenue streams, potentially involving dedicated funds and government support.
- **Market Creation is Key:** Establishing clear offtake agreements and building demand for biogas and biofuels are essential to drive commercialization.
- **Policy Certainty and Mandates Can Accelerate Growth:** Clear policy roadmaps, blending mandates, and government commitment are vital for creating a stable investment environment.
- **Standardization is Crucial for Bankability:** Standardizing feedstock quality, gas specifications, and digestate characteristics will build trust and facilitate market development.
- **Integration Across Sectors:** Synergies with the waste management and agriculture sectors need to be leveraged for sustainable feedstock supply and byproduct utilization.
- **Energy Security and Decarbonization are the Ultimate Drivers:** The bioenergy sector's growth should be aligned with India's broader energy security and climate change mitigation objectives.
- **Focus on "Full-Stack" Solutions:** Addressing the entire value chain, from feedstock to end-use, is necessary for creating a thriving and scalable bioenergy economy.

TRACK D-CITIS SESSION D3

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Economics and Investments in Energy - Bio Gas and Biofuels (Focus on Waste)

Day 2:
Thursday; December 5, 2024
1400 – 1530 hrs

Moderator:
Mr. Sanmit Ahuja
(Expert Member, cGanga, IIT Kanpur)

Lead Discussants:
Mr. Sameer (Innovative Water Technology)
Mr. Abhishek Mundra (Geo Miller)
Mr. Nishant (Voltas Green Funding)
Col. Sumeet Madhan (PRESPL)
Ms. Sanghamitra (Deloitte)
Mr. Samir Shah (Peak Sustainability Ventures)
Ms. Aarti (World Bio Gas Association)
Mr. Vipin Singh (SMCG, UP)
Mr. Mudit Jain (Tata Capital)
Mr. Rohit (Biogas and Seaweed)
Mr. Aditya Sharma (Boson Energy)
Mr. Saurabh Kumar (Keystone Energy)
Mr. Rob Sampson (Ceres Biosystems)
Mr. Kevin Andrews (Core Financing International)
Mr. Rahul Mancotia (KfW Development Bank)
Mr. Ankit Todi (Mahindra Group)
Mr. Rohit Rajput (Intersection Ventures)
Mr. Sourav Das Patnaik (Swach Environment Ltd.)
Mr. Ashish Mathur (Ambitum Recycling)
Mr. Pankaj Agarwal (Panitek Green Ventures, Zurich)
Ms. Ishita (Deloitte)
Dr. Salil Kumar Jain (Amity University)
Mr. Yashodan Ramteke (Meta Material Circular Markets)
Mr. Nitesh (Circular Economy Alliance)
Dr. Karthik (Visvesvaraya National Institute of Technology)
Mr. Charles Kennedy (GCSWF)
Ms. Lianda (Student & Intern, Bharatia)
Dr. Ashwini Keskar (Pune Knowledge Cluster)
Ms. Anne (Sharda University)
Mr. Lincon (PPC Zimbabwe)

BACKGROUND

FOAK Focus: Solid Waste Sorting Solutions

Objective:

- Develop and implement new technologies for effective waste sorting and segregation at the source.
- Establish a foundation for the circular economy by improving waste management efficiency.

Innovative Technologies:

- Deployment of AI-powered sorting systems to identify and separate materials such as plastics, metals, and organics.
- Use of advanced robotics for precision sorting and automation to reduce manual intervention.
- Incorporation of IoT-enabled waste bins to categorise waste at the collection stage and provide real-time data.

Integration of Smart Solutions:

- Leverage machine learning and computer vision to enhance the accuracy and speed of waste segregation.
- Create networks of connected systems that enable dynamic adjustments based on waste composition trends.
- Provide user-friendly interfaces for households and industries to improve participation in source segregation efforts.

Challenges:

- Resistance to change in traditional waste management practices.
- High initial investment costs for smart technologies.
- Limited technical expertise in operating and maintaining advanced sorting systems.

Role of Commodity Funds:

- Facilitate the establishment of sorting and storage centres by offering low-cost financing.

This session focused on the economic and investment aspects of bioenergy, particularly biogas and biofuels derived from waste streams. It aimed to identify viable business models and address challenges in scaling up these technologies, while ensuring they contribute to both energy security and environmental sustainability.

- Support early-stage innovation in waste technologies through targeted investments.
- Create value chains for recovered materials by linking sorting centres to recycling facilities and end-users.

Benefits:

- Enhanced resource recovery from waste streams, reducing landfill dependency.
- Improved efficiency and cost-effectiveness in waste management operations.
- Creation of jobs in technology-driven waste management sectors.

NOAK Focus: Large-Scale Sorting Centres as a Service

Objective:

- Scale up waste management systems by establishing large hub-and-spoke sorting centres.
- Transition from piecemeal waste handling to a service-based model for municipal and industrial waste management.

Scaling Large-Scale Sorting Centres:

- Develop regional hubs that process waste from multiple collection points, increasing efficiency.
- Design modular and scalable sorting centres to cater to varying volumes of waste.
- Focus on integrating renewable energy solutions into sorting operations to minimise carbon footprints.

Hub-and-Spoke Model:

- Create centralised hubs for waste sorting, with smaller satellite centres (spokes) for collection and pre-segregation.
- Enable the efficient flow of segregated waste to recycling units or final disposal sites.

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- Reduce logistics costs and optimise material recovery rates through strategic placement of hubs.

Service-Based Models:

- Offer waste sorting and management services to municipalities and industries on a subscription or pay-per-use basis.
- Develop tailored solutions for different sectors, such as construction, e-waste, and food processing.
- Provide data-driven insights to clients, helping them track and improve waste management performance.

Challenges:

- High operational costs in the initial phases of establishing sorting centres.
- Securing long-term contracts with municipalities and industries for steady revenue streams.
- Regulatory hurdles in obtaining permits and aligning with waste management policies.

Benefits:

- Streamlined waste management practices with reduced environmental impact.
- Economies of scale that make waste recovery and recycling financially viable.
- Increased adoption of circular economy principles through improved waste recovery infrastructure.

DISCUSSION

This session focused on the economic and investment aspects of bioenergy, particularly biogas and biofuels derived from waste streams. It aimed to identify viable business models and address challenges in scaling up these technologies, while ensuring they contribute to both energy security and environmental sustainability.

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Government policies, mandates (e.g., blending mandates, ZLD), and financial incentives are crucial for creating a level playing field and driving market development.

Presentations and Discussions:

- **Setting the Stage:** Mr. Sanmit Ahuja, the moderator, highlighted the transition from a water-centric focus to a broader view encompassing the interplay of water, energy, land, and agriculture. He explained the purpose of the Climate Investments and Technology Impact Summit (CITIS) as a parallel event to the India Water Impact Summit (IWIS), aiming to bring together diverse disciplines to address climate challenges. The session focused on the "First of a Kind" (FOAK) to "Nth of a Kind" (NOAK) framework, which emphasizes the need for innovative solutions that can be scaled effectively.

Biogas Economy in India:

- **Mr. Subhash Kumar:** Emphasized that CBG plants are not new but haven't scaled up due to a lack of investment in technology, standardization, institutions, and manpower. He stressed the need to price in the externalities of current waste handling and leverage India's abundant bio-residue potential.
- **Mr. K S Popli:** Noted that few large-scale CBG plants are operational, attributing this to a lack of viable revenue streams. He highlighted the importance of addressing offtake issues and standardizing digestate management.
- **Ms. Sangeeta Kasturi (MNRE):** Outlined the government's support for the sector through programs like SATAT and biofuel policies, with a focus on achieving 20% blending by 2025 and establishing 5000 CBG plants. She acknowledged challenges related to feedstock supply, pricing, and the need for robust technologies.

Key Challenges in Biogas and Biofuel Sector:

- **Feedstock Availability and Pricing:** Ensuring a consistent and affordable supply of biomass and agricultural residues is a major hurdle.
- **Technology & Design:** Current biogas plant designs and purification technologies often lead to low efficiency and high operational costs.
- **Lack of Standardization:** The absence of standardized processes for sludge management and digestate utilization creates uncertainty and hinders market development.
- **Market Creation:** Establishing viable markets for biogas, biofuels, and byproducts like digestate is crucial for attracting investment.
- **Financial Viability:** Many bioenergy projects struggle to achieve profitability, requiring innovative financing models and government support.
- **Policy and Regulatory Framework:** Clear and supportive policies are needed to incentivize investment, promote technology adoption, and address issues like waste segregation and pricing.
- **Integration of Waste Streams:** Effective management requires integrating different waste streams (municipal solid waste, industrial waste, agricultural residue).
- **Public Perception and Trust:** Overcoming public scepticism about the quality and safety of recycled water and bio-products is essential.
- **Scaling and Replication:** Moving beyond pilot projects to widespread deployment requires addressing financial, technical, and logistical challenges.

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Economics and Investments in Energy - Bio Gas and Biofuels (Focus on Waste)

Potential Solutions and Strategies:

- **Decentralized Systems:** Promoting decentralized wastewater and waste treatment systems to reduce transportation costs and enable local reuse.
- **Developing Robust Value Chains:** Creating efficient and integrated value chains for biomass and waste, from collection to processing and end-use.
- **Establishing Clear Pricing Mechanisms:** Implementing pricing models that reflect the true value of water and waste, incentivizing resource efficiency and cost recovery.
- **Government Support and Policy Intervention:** Government policies, mandates (e.g., blending mandates, ZLD), and financial incentives are crucial for creating a level playing field and driving market development.
- **Standardization and Certification:** Developing standardized processes for feedstock quality, gas purification, and sludge/ digestate characterization to build trust and facilitate trade.
- **Technology Innovation and Adaptation:** Investing in research and development of cost-effective and efficient bioenergy technologies, including multi-feedstock processing and advanced purification methods.
- **Creating Markets for Byproducts:** Exploring and developing markets for byproducts like digestate and biochar to improve project economics.
- **Addressing Negative Externalities:** Pricing in the environmental and health costs associated with waste generation and pollution to incentivize sustainable practices.
- **Public Awareness and Education:** Educating the public about the benefits of water reuse, bioenergy, and responsible waste management to foster acceptance and participation.

- **Collaboration and Integration:** Encouraging collaboration among various stakeholders (government, industry, researchers, investors, communities) to address the complex challenges.

Specific Points Raised:

- The need to move beyond a "one-size-fits-all" approach and tailor solutions to specific local and regional contexts.
- The importance of addressing the "who pays?" question and finding equitable ways to distribute the costs and benefits of sustainable water and waste management.
- The potential of "contracts for difference" to provide price stability and reduce risk for investors in bioenergy projects.
- The potential for India to become a global leader in climate technologies by focusing on cost-effective and scalable solutions for emerging markets.
- The need to consider the energy footprint of various solutions, including water treatment and reuse.
- The importance of public trust and awareness in the adoption of recycled water and bio-products.
- The role of "corporate climate activists" in driving sustainable practices within large corporations.
- The potential of biochar as a valuable byproduct of biogas production and its benefits for soil health.
- The need for a "whole of government" approach, involving various ministries and departments, to address the interconnected challenges of water, energy, and waste.

GIST

The session explored the economic and investment challenges in scaling up bioenergy (biogas and biofuels) and waste management solutions in India. It highlighted the need to create viable markets, incentivize private sector participation, and develop robust policy frameworks that address the complex interplay of technology, economics, and environmental sustainability. The discussion emphasized the importance of cost-effective solutions, standardized processes, and a shift towards a circular economy model that values resources and minimizes waste.

KEY TAKE AWAY POINTS

- **Market Creation is Paramount:** Establishing clear and reliable markets for bioenergy and waste-derived products is the primary driver for investment and scaling.
- **Economic Viability is Key:** Projects must be economically viable to attract private investment and ensure long-term sustainability.
- **Government Plays a Crucial Role:** Supportive policies, regulations, and incentives are needed to de-risk investments and create a level playing field.
- **Technology Alone is Insufficient:** Effective solutions require a holistic approach that integrates technology, economics, policy, and social considerations.
- **Collaboration is Essential:** Collaboration among government, industry, researchers, investors, and communities is vital for achieving impactful outcomes.
- **Standardization and Certification are Needed:** Establishing clear standards for feedstock, processes, and product quality is crucial for building trust and facilitating market development.
- **Context-Specific Solutions are Necessary:** Solutions must be tailored to the specific context of each region, considering local resources, infrastructure, and demand.
- **Internalize Environmental Costs:** Pricing in the negative externalities of waste generation and pollution is essential for promoting sustainable practices.
- **Focus on Resource Efficiency and Circularity:** Moving towards a circular economy model that maximizes resource utilization and minimizes waste is key to long-term sustainability.

Investing in Agriculture

Day 2:
Thursday; December 5, 2024
1600 – 1745 hrs

Moderator:
Mr. Sanmit Ahuja
(Expert Member, cGanga, IIT Kanpur)

Lead Discussants:
Mr. Milind Kayande (Renmakch India Pvt. Ltd.)
Dr. Suresh Kulkarni (Irrigation Specialist, Govt. of Maharashtra)
Dr. S D Gorantiwar (Mahatma Phule Agricultural University)
Mr. Samir Shah (Peak Sustainability Ventures)
Mr. Mithilesh Kumar Mishra (State Mission for Clean Ganga, UP)
Mr. Anil Kumar Gupta (State Mission for Clean Ganga, UP)
Mr. Anoop Jain (Blue-Green Ventures)
Mr. Maksood Ahmed (Delhi University)
Ms. Prakhriti (Penn State University)
Mr. Utkarsh Roy (University of Alabama)
Mr. Rob Sampson (Ceres Biosystem)
Mr. Kevin Andrews (Core Finance International Limited)
Dr. Shravan Muppa (India Meteorological Department)
Mr. Ankit Todi (Mahindra Group)
Mr. Sundar Rao (Renmack Industries)
Mr. Rajnish (Deccan Environmental Consultants, Pune)
Mr. Rohit (Mahindra Group)
Mr. Shanag Dharod (GMEX Group Zero B)
Ms. Sakshi Chak (cGodavari, IIT Hyderabad)
Mr. Rohit Wadhera (Biogas and Seaweed)
Ms. Shalom Manamela (GCSWF)
Ms. Nicole (Global Social Welfare)
Mr. Sunny Vaish (Prithu)
Ms. Lianda (Student and Intern)
Ms. Annie (Sharda University)
Mr. Lincoln (PPC Zimbabwe)

BACKGROUND

FOAK Focus: Increasing Farm Yields

Objective:

- Develop and deploy innovative solutions to increase agricultural productivity while maintaining environmental sustainability.
- Rejuvenate degraded soils and improve irrigation efficiency to ensure long-term yield stability.

Rejuvenating Topsoil:

- Promote soil health through regenerative agricultural practices, such as crop rotation, cover cropping, and reduced tillage.
- Use biofertilisers and soil amendments like compost, biochar, and mycorrhizal fungi to restore organic matter and nutrients.
- Employ microbial and enzymatic solutions to break down compacted soil layers and enhance soil structure.
- Monitor soil health with precision tools that assess nutrient deficiencies, pH levels, and organic matter content.

Innovations in Irrigation Efficiency:

- Deploy drip irrigation and micro-sprinkler systems to reduce water wastage and target water delivery directly to plant roots.
- Integrate smart irrigation controllers that adjust water usage based on real-time weather data and soil moisture sensors.
- Explore desalination and wastewater recycling technologies to provide alternative water sources in arid regions.

- Train farmers in water-saving techniques, such as alternate wetting and drying for rice cultivation.

Challenges:

- Limited awareness and accessibility to modern soil and irrigation technologies for smallholder farmers.
- High initial costs for implementing advanced systems and regenerative practices.
- Resistance to transitioning from traditional farming methods to innovative approaches.

Benefits:

- Improved soil fertility and structure, resulting in sustained and enhanced crop yields.
- Significant reductions in water usage, ensuring water security for future agricultural needs.
- Greater resilience to climate change impacts, such as droughts and erratic rainfall patterns.

NOAK Focus: Large-Scale Farm Infrastructure-as-a-Service

Objective:

- Scale up farming infrastructure solutions by introducing service-based models tailored for large-scale agricultural operations.
- Reduce the capital burden on farmers while ensuring access to modern infrastructure and technology.

Investing in Agriculture

Scaling Farming Infrastructure:

- Offer shared access to heavy machinery, such as tractors, harvesters, and seed drills, reducing the need for individual ownership.
- Develop centralised storage facilities for crops, ensuring post-harvest quality and minimising losses.
- Provide advanced greenhouse systems for high-value crops, improving yield consistency and quality.
- Facilitate access to precision agriculture tools, such as drones and GPS-enabled equipment, for large-scale operations.

Service-Based Models:

- Implement pay-per-use systems for farming equipment, allowing farmers to utilise modern machinery without large investments.
- Create subscription-based services for irrigation infrastructure, greenhouse operations, and soil testing.
- Develop cooperative models where farmers pool resources to access shared infrastructure and services.
- Integrate digital platforms that connect farmers with service providers, ensuring transparency and efficiency.

Challenges:

- Logistics of managing and maintaining large-scale shared infrastructure.
- Ensuring equitable access to services across different farming communities.
- High costs of establishing service-based infrastructure systems in underdeveloped regions.

Benefits:

- Reduction in upfront costs for farmers, enabling them to invest in other aspects of farming.
- Improved productivity and profitability through access to state-of-the-art infrastructure.
- Creation of new jobs and industries around service-based agricultural models.
- Enhanced scalability of modern farming practices, leading to greater food security at regional and national levels.

DISCUSSION

This session of the 2nd Climate Investments and Technology Impact Summit focused on the critical area of investing in agriculture, utilizing the "First of a Kind" (FOAK) to "Nth of a Kind" (NOAK) framework. The discussion aimed to identify pathways to increase farm-level yields, enhance farmer income, promote resource security, and transition towards climate-resilient agricultural practices, while also considering the socio-economic implications and the need to avoid excessive urbanization.

Key Themes and Discussion Points:

- **The FOAK to NOAK Framework in Agriculture:** The session aimed to identify and scale up innovative solutions in agriculture, encompassing technology, policy, operational frameworks, community integration, economic and financial models, and legal frameworks.
- **Problem Statement: Increasing Farm-Level Yields:** The core challenge addressed was

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how to improve agricultural productivity and farmer income, considering factors like land arability, market access, and regional specificities.

- **Paradigm Shift Needed:** The discussion emphasized the necessity of moving beyond traditional farming practices and adopting new technologies and approaches to make agriculture more attractive, productive, profitable, and environmentally friendly, thereby discouraging rural-to-urban migration.

State of Farming in India:

- **Dr. S D Gorantiwar:** Highlighted the need to enhance farmer income and provide economic opportunities in rural areas. He pointed out the lack of a proper supply chain from harvesting to consumers and the slow adoption of modern technologies beyond minor modifications of existing practices. He cited Central Pivot irrigation and digital technologies as examples with significant potential.
- **Absorption Capacity:** While acknowledging the large population dependent on agriculture in rural areas, Dr. Gorantiwar noted a slow absorption rate for new technologies, emphasizing the need for farmer-friendly and user-friendly solutions.
- **Climate Impact of Agriculture:** The significant impact of agriculture on climate change (over-extraction of water, fertilizer runoff, land erosion, emissions from livestock) was discussed. The failure to address these issues effectively despite numerous attempts was a key concern.

Emphasized climate resilient agriculture, advising farmers on suitable crops and modifying agricultural practices (e.g., water-efficient rice cultivation). Mr. Samir Shah stressed capturing more value for farmers and addressing the nonfunctionality of many Farmer Producer Organizations (FPOs) by providing necessary funding and fixing the broken supply chain that leads to significant post-harvest losses.

NOAK Aspects: Scaling Solutions:

- **Mr. Anoop Jain:** Focused on the NOAK aspect, highlighting the low income of farmers and the problem of small landholdings driving migration. He pointed to the colossal food waste due to a lack of cold chain logistics and warehousing infrastructure as a key area for investment and service-based models. He also questioned the effectiveness of current subsidy models.

- **Mr. Samir Shah:** Emphasized climate-resilient agriculture, advising farmers on suitable crops and modifying agricultural practices (e.g., water-efficient rice cultivation). He stressed capturing more value for farmers and addressing the non-functionality of many Farmer Producer Organizations (FPOs) by providing necessary funding and fixing the broken supply chain that leads to significant post-harvest losses. He also suggested exploring alternative crops like hemp and the potential of biochar for soil health.

- **Technological Solutions and Adoption:** The discussion touched upon technologies like "Happy Seeder" and "Smart Seeders" for residue management and timely sowing, as well as the potential of drip irrigation. However, the slow adoption rates due to complexity and lack of awareness were noted.

- **Market Dynamics and Farmer Compensation:** The low compensation received by farmers for their produce was identified as a critical issue affecting their willingness to adopt new practices or care about downstream industries. The

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need to price in the social cost of current agricultural practices was highlighted.

- **Value Chain Development:** Building a robust value chain from harvesting to consumers, including storage, transportation, and processing at the village level, was deemed essential for improving farmer income and reducing waste. The success story of the Sahabri Farm FPO in Nashik was cited as an example.
- **Policy and Government Role:** The importance of government policies in promoting sustainable agriculture, supporting FPOs, and investing in infrastructure (like cold storage and processing units) was emphasized. The potential of the Digital Agriculture Mission was also noted.

- **Soil Health as a Priority:** The declining organic content in Indian soils and its negative impact on water retention and productivity were discussed. Returning organic matter and carbon to the soil through practices like biochar application was advocated. The National Topsoil Rejuvenation Mission was highlighted.
- **Water Efficiency:** The need to shift towards more crop per drop through efficient irrigation technologies like drip irrigation and addressing water-intensive crops in drought-prone areas (like sugarcane in Maharashtra) were raised. The concept of water regulation with fixed quotas for farmers, as practiced in some other countries and regions in India, was suggested.
- **Risk Mitigation and Financial Models:** De-risking investments in agricultural infrastructure and technologies through innovative financial models was deemed crucial for attracting private sector participation.

KEY TAKE AWAY POINTS

- **Enhancing Farmer Income is Paramount:** Strategies must directly benefit farmers economically to drive adoption of sustainable practices.
- **Value Chain Development is Crucial:** Building efficient supply chains from farm to consumer is essential to reduce waste and increase farmer profits.
- **Technology Adoption Needs to be Farmer-Centric:** Innovations must be user-friendly and address the specific needs and constraints of small land holder farmers.
- **Addressing Post-Harvest Losses is a Priority:** Investing in cold storage and processing infrastructure at the local level can significantly reduce food waste.
- **Climate-Resilient Agriculture is Essential:** Promoting sustainable practices, water-efficient irrigation, and soil health improvement is vital for long-term food security.
- **Government Policies and Support are Key:** Strategic policies, financial incentives, and infrastructure investments are necessary to drive the transformation of the agricultural sector.
- **Holistic Approach Required:** Addressing the complex challenges in agriculture requires an integrated approach considering technology, economics, social factors, and environmental sustainability.
- **Learning from Success Stories:** Existing successful models like the Sahabri Farm FPO and localized interventions should be studied and replicated.
- **Data-Driven Decision Making:** Accurate and timely data on climate, soil health, water usage, and crop yields are crucial for informed policy and investment decisions.
- **Avoiding Unstructured Urbanization:** Bringing economic opportunities and amenities back to rural farmlands can help stem the tide of migration to overburdened cities.

GIST

The session highlighted the urgent need for a paradigm shift in Indian agriculture to increase farm-level yields, enhance farmer income, and promote climate-resilient practices while avoiding excessive urbanization. The discussion identified key challenges such as inefficient supply chains, slow technology adoption, inadequate farmer compensation, significant post-harvest losses, and the climate impact of current agricultural practices. Potential solutions focused on developing robust value chains, promoting farmer-friendly technologies, investing in infrastructure (cold storage, processing), implementing water-efficient irrigation, improving soil health, and leveraging government policies and innovative financial models to attract investment and ensure the sustainability of the agricultural sector.

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Valedictory Session of IWIS-CITIS 2024

Day 3:
Friday; December 6, 2024
1400 – 1530 hrs

Key Speakers:

Dr. Vinod Tare
(Former Professor, Founder & Advisor, cGanga, IIT Kanpur)

Mr. Sanmit Ahuja
(cGanga, IIT Kanpur)

Dr. Mohammad Jawed
(IIT Guwahati)

Dr. P Bose (IIT Kanpur)

Mr. Siddharth Desai
(Kishor Pumps, Pune)

Mr. Sanmit Ahuja opened the final valedictory session of the combined Twin Summits, noting the intensive dialogues, conversations, insights, innovations, and ideas shared over the preceding 2.5 days. Emphasizing that the session was primarily for participant feedback, he outlined the plan to provide a summary of each session before opening the floor for ideas, contributions (both positive and negative regarding the event and its content), and importantly, suggestions and recommendations for future action. He then invited Dr. Vinod Tare to discuss the initial concept behind the IWIS headline and assess whether the deliberations aligned with that vision.

Dr. Vinod Tare reflected on the journey of the India Water Impact Summit (IWIS) since its inception in 2012, initially conceived for getting inputs for preparing the Ganga River Basin Management Plan by Consortium of 7 IITs (IITC).

The current summit's theme, "Learning from the Past and Strategizing for the Future," was driven by the ongoing drafting of the second version of Ganga River Basin Management Plan (GRBMP 2.0) and the Condition Assessment and Management Plan (CAMP) project for the six river basins of India namely, Mahanadi, Narmada, Godavari, Krishna, Cauvery & Periyar. It is important to understand the need for honest self-assessment and internalize teachings (शिक्षा), warnings (चेतावनिया) and punishments/penalties (फटकार) received on various fronts including judicial proclamations.

The current summit's theme, "Learning from the Past and Strategizing for the Future," was driven by the ongoing drafting of the second version of Ganga River Basin Management Plan (GRBMP 2.0) and the Condition Assessment and Management Plan (CAMP) project for the six river basins of India namely, Mahanadi, Narmada, Godavari, Krishna, Cauvery & Periyar.

The summit was aimed at getting feedback on objectives and framework of River Basin Management Plan developed by cGanga and NMCG titled as Samarth Ganga (समर्थ गंगा), comparing them to advanced international river management programs like those for Thames, Rhine, Denube, Murray-Darling river basins. While objectives are largely similar (restoring indicator species), the vision river Ganga emphasizes on human behaviour that has minimal interventions on the river's natural functions and processes ("Samarth Ganga"). This is a much broader concept that applies to all Indian rivers and captures the "Spirit of Ganga."

The summit expanded to include six additional river basins and twelve more institutions. Discussions covered the CAMP project, sought public input and highlighted the importance of collaboration between academic institutions and the government, with increased trust and support.

Key discussion points included

- **Objectives and Framework:** Assessing their appropriateness and the need for changes.
- **Means for River Conservation:** Importance of program cycles with defined budgets and achievable targets as in European Programmes. The critical need for convergence among various government programs (Jal Jeevan Mission, Swachh Bharat Mission, etc.) at the implementation level. The example of STP sludge management studies being carried out highlights the lack of inter-departmental coordination.
- **Policy, Law, and Governance:** The evolution from proposing a special Ganga law to working within existing mechanisms like the National Mission for Clean Ganga (NMCG). The creation of state and district Ganga committees and the proposal for divisional-level committees to bridge the gap between planning and implementation. The importance of stakeholder ownership and river custodianship. The challenge of state-centric perspectives hindering a holistic river basin approach.
- **Public Participation:** Moving beyond symbolic actions such as rallies, demonstrations, etc. to active involvement in monitoring and decision-making, such as in monitoring river health in various stretches through balancing advanced monitoring with participatory approaches, participating in planning for STP locations and capacities, placement and functionality.
- **Economics and Financing:** Acknowledging the vast financial gap in achieving desired outcomes

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for sewage treatment and infrastructure. Questioning the long-term sustainability of current approaches like interception and diversion and advocating for decentralized sewage treatment.

- **Environmental Flows:** Graduating from defining E-flows and evolving methodology for assessment to implementing them by empowering local stakeholders to determine flow requirements.
- **Nature-Based Solutions:** Moving beyond extreme views to a four-layer strategy that integrates both advanced technological options and nature-based solutions for water quality improvement. Rethinking reuse and recycle concepts to include provision of treated used water for natural systems. Addressing the challenge of managing both excess water during floods and sewage during dry periods.
- **Indigenous Aquatic Life:** Recognizing the lack of baseline data and strategizing to gather information for effective restoration planning.

The speaker concludes by expressing satisfaction with the feedback received and looks forward to future discussions and progress, and invited Mr. Siddharth Desai, moderator of Sessions A4 and A6 to summarise the discussions.

Mr. Siddharth Desai: During the session on public participation, we had a productive exchange, and while the detailed proceedings will be available, I'd like to highlight three or four key takeaways.

Firstly, a fundamental question arose: why should the public actively participate in related campaigns and programs? As ordinary citizens, what would motivate us to engage? Several points were discussed, and Dr. Jawed emphasized the importance of the traditional connection people had with water bodies, including rivers. This connection has weakened due to urbanization and lifestyle changes, and re-establishing it is vital to encourage participation in conservation and restoration efforts. Exploring ways to strengthen this bond was a key focus. Furthermore, particularly in urban

areas, the increasing loss of recreational spaces to development means that revitalized riverfronts could serve a dual purpose. Ultimately, the core question of citizen motivation remains central and will be further explored in GRBMP 2.0.

Secondly, the session highlighted numerous micro-level initiatives undertaken by local communities, NGOs, social enterprises, and various organizations across both the Ganga and non-Ganga river basins to foster public engagement with water bodies and rivers. A crucial point was the need for a systematic approach to identify these ongoing efforts, establish a mechanism for incorporating their feedback into the system for evaluation and recognition (as recognition can be highly motivating), and then scale up successful models across suitable geographies and regions. This was a significant piece of feedback received.

Thirdly, we discussed the sustainability of these efforts and the work being done by various institutions. Ensuring that successful initiatives continue beyond initial traction and operate effectively on a day-to-day basis is important. We pondered how to systematize these mechanisms to put initiatives on a kind of 'autopilot' mode. While no specific answers were reached, this remains a key area for debate and the development of options for the next version of the plan.

Finally, regarding the public participation session, the critical role of urban local bodies (ULBs) as the primary interface between government and citizens, and often as

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implementing agencies, was underscored. A high level of trust between the citizenry and local bodies (including Gram Panchayats) is essential for any meaningful collaboration and public participation. The discussion referenced Indore's consistent ranking as a top city for cleanliness and water quality, attributing it in part to strong trust between the administration and citizens. Identifying mechanisms to enhance this trust in other local contexts was a key consideration.

Moving on to the other session I moderated, which focused on the quantum and efficiency of enablers under GRBMP-2015 and the convergence achieved, we identified seven or eight key takeaways that will be published. However, I'd like to highlight three important aspects.

Firstly, as Dr. Tare previously mentioned, significant policy contradictions and overlaps exist across all levels of government. Often, an enabling policy under one program can conflict with a policy under another, hindering effective execution. We discussed examples of this and the need to address policy contradictions and overlaps through policy harmonization across specific areas or departments. Establishing an institutionalized mechanism to provide feedback on these policy dichotomies and drive harmonization was a key point that will contribute to eventual convergence.

Secondly, we were pleased with the strong representation from the people associated with the working of District Ganga Committees (DGCs) during the session. We learned about many active initiatives being undertaken by these committees,

including cross-collaboration with other programs like MGNREGA to achieve GRBMP objectives. However, a key issue hindering their further work and convergence was the perceived lack of empowerment. We discussed what steps could be taken to further empower DGCs. Mr. Asok Kumar, Former DG, NMCG suggested leveraging the existing Jal Shakti Kendras in various districts, aiming to activate them similarly to DGCs to enhance convergence, public engagement, and audit/monitoring at that level. This was a significant suggestion.

Finally, a crucial long-term consideration for achieving convergence is establishing a common objective and purpose. One key aspect of this is behaviorally induced convergence. We discussed how to foster behavioral changes that align with a common goal. The example of Singapore's targeted education of children was shared, highlighting its potential for a multiplier effect within households. Identifying and promoting successful behavior change initiatives at micro-levels in India was also a key consideration for the session.

Dr. Jawed added a few interesting points regarding public participation. A critical issue raised was the apparent lack of concern among the next generation for rivers, air, water, and soil. Whatever efforts we're making aren't really for ourselves, as our lifespans might be too short to witness significant change. A key point here is that to truly increase the participation of the next generation, we must engage them from a young age. Unfortunately, the prevalence of nuclear families means that the traditional storytelling by grandparents, which often instilled values about nature and mythology, is largely absent. If we don't cultivate an understanding of the importance of rivers, deities, mythology, air, and fire in children from their early years, they are unlikely to develop an interest in these things, often becoming absorbed in mobile devices and online searches instead. This is a very genuine concern: when we talk about why the public, especially the youth, should participate in these endeavors, the question is, where do we begin? We can't start here in these conferences; we need to start at home by educating children from childhood. Without this

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foundational understanding, achieving meaningful change will be difficult.

Regarding the discussion on Quantum and Essentials, a vital point emerged: educated individuals often struggle to converge. If we discuss ten points, we should aim to converge on at least two and begin working on those. We should approach this with the understanding that we have a common objective, supported by ten components that need addressing. However, even if we can agree on and start working on just two or three components, we will likely see positive changes, which in turn will foster greater convergence. The word 'convergence' itself is tricky. Our goal should be to first discuss, regardless of whether immediate convergence occurs. A group of people will naturally agree on some ideas, and initiating action from that common ground can lead to positive momentum and increased agreement. Additionally, in the public participation session, the active engagement of young participants, who raised critical comments and sparked lively discussions, was very encouraging. Both our sessions saw strong participation and valuable contributions.

Dr. Purnendu Bose: I had the pleasure of chairing sessions B1 and B2, which ran concurrently with A1 and A2. Session B1 focused on Environmental Flows, the concept that a portion of a river's water should remain within its channels to sustain its ecological functions. When this idea first emerged, around 2007-2010, it was largely theoretical. We lacked concrete methods to determine the necessary water volumes or the criteria for their calculation. I'm pleased to report that we now possess well-defined criteria for calculating environmental flows. There's a widely accepted procedure to ascertain the required flow at various points along a river. In fact, the Government of India has notified minimum flow requirements as Environmental Flows for river Ganga in some stretches, specifying the percentage of flow that must be maintained during different seasons.

However, the challenge lies in implementing these notifications, given the multiple demands on river water. If water is retained for the river's health, questions arise regarding allocation for agriculture, industry, domestic use, and electricity generation. This is where the implementation difficulties surface. We had three insightful speakers in B1: Mr. Suresh Babu and Ms. Laura discussed their efforts to implement mandated flows for the Ram Ganga River. Notably, water is now being released from the upstream barrage near Moradabad into the Ramganga specifically to maintain ecological balance – a significant improvement. Furthermore, it was highlighted that augmenting flows isn't solely reliant on barrage releases; rejuvenating tributaries and wetlands along the Ramganga and increasing the water table were presented as effective alternative strategies. Overall, the discussion was very positive, suggesting a potential path towards ensuring environmental flows in all Indian rivers in the future. It was both informative and engaging. We also heard from Mr. Mathuria from the CWC, who shared practical hurdles in implementing and monitoring environmental flows, such as verifying compliance with mandated releases. This added another interesting dimension to the session.

Moving to the next session, B2, we explored nature-based methods of wastewater treatment. Here, we had a fascinating presentation by Ms. Devika from the Art of Living Foundation campus in Bangalore, where all wastewater generated is treated adopting nature-based systems. She provided examples of phytoremediation using algae, phytoremediation employing aquatic plants, and bioremediation being utilized to treat wastewater effectively. We also had another informative contribution from Mr. Mathuria of the CWC, who discussed the use of constructed wetlands for wastewater treatment, particularly in rural areas, and the associated challenges. A common concern one might expect is the large land area often required for nature-based wastewater treatment, potentially making it impractical. However, surprisingly, both speakers argued that this is often an excuse rather than a fundamental limitation. They suggested that the primary reasons for the underutilization of these methods are a lack of will, improper design, and inadequate management, including operation and maintenance. With proper attention, these systems can indeed work and deliver good performance, at least in specific contexts.

Mr. Sanmit Ahuja summarized proceedings of Track C (ETV Program) and Track D (Economics & Finance and the Water-Land-Agriculture-

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Energy Nexus). Track D highlighted the need to understand the interplay within the water nexus for a complete economic cycle. The CITIS plenary emphasized the importance of the "first of a kind" (FOAK) in technology adoption, arguing that initial deployments shouldn't be judged solely on L1 (lowest cost) but prioritize quality. Separating FOAK from subsequent "nth of a kind" procurements is crucial to avoid repeated mistakes.

Investing in the water sector, particularly STPs, faces challenges with underutilized capacity due to poor master planning. Investors are hesitant without clear revenue models for ULBs, hindered by low revenue recovery and high non-revenue water. Creating local water markets through data digitization and matching bulk producers and consumers is essential.

In the energy sector, bioenergy potential is significant, but biogas plants face viability issues due to feedstock availability, inconsistent gas production, and over-reliance on digestate sales. Investing in advanced biogas technologies and establishing centres of excellence is needed. The waste session focused on the economic failures in managing crop residue for bioenergy, proposing a commodity fund and warehousing to stabilize feedstock supply.

Agriculture discussions centred on lowering input costs and increasing yields through hygienic sludge and efficient irrigation. Recognizing the complexity of changing farming behaviour, targeted commercial-scale pilots are necessary.

Key announcements included Meghalaya becoming a key partner in sustainability and climate change, launching green data centres (leveraging hydropower), and collaborating on sustainable farming and sludge management. A climate change executive education program with NLU Meghalaya was launched, and Meghalaya announced plans to host an annual conference focused on emerging markets, parallel to COP.

The ETV program has successfully brought innovative technologies to India, achieving significant (60-70%) cost reductions through indigenization. The "triple-A framework" (Accessible, Affordable, Available) drives technology adoption. The idea of creating strategic clusters of excellence across national institutes

for FOAK projects was proposed, along with a focus on technology commercialization by bringing incubators and accelerators together.

The valedictory session of the Twin Summits also focused on gathering feedback and charting the path forward. Participants suggested quarterly online sessions and hybrid formats to maintain the network and broaden participation beyond Delhi. The idea of hosting smaller, half-day workshops in various institutes was also proposed to engage local stakeholders.

A participant emphasized the importance of community involvement, suggesting the inclusion of non-professionals and local individuals like shepherds in river monitoring programs. This was supported by the organisers, who highlighted the need to empower communities for effective citizen participation in river assessment.

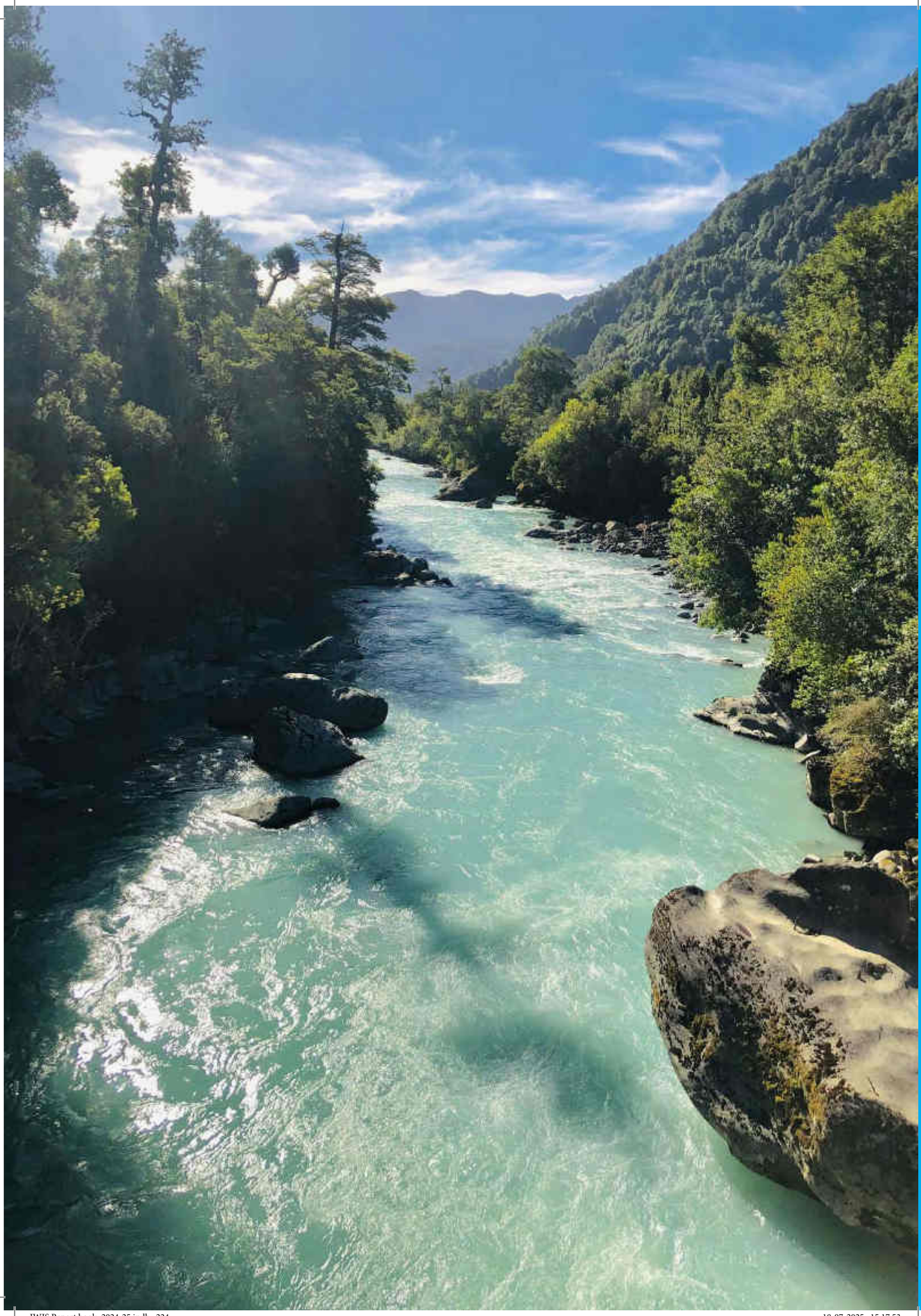
Mr. Arvinder Brara stressed the need for stricter enforcement and penalties to deter pollution in rivers like the Ganga and Yamuna, drawing a contrast with rule-following behaviour abroad. Another participant suggested localized awareness campaigns detailing the specific environmental status and required improvements for communities along different river stretches.

Mr. Manoj Tandon proposed a model similar to the National Highway Authority, allocating stretches of rivers to corporate entities or agencies for maintenance, potentially funded by government grants or tourism revenue.

Practical examples of successful plastic ban implementation through strict enforcement and community engagement in preventing open defecation were shared. However, another perspective emphasized the importance of educating the public alongside implementing rules, citing the limitations of enforcement alone.

Mr. Anit Yadav, a researcher in river health assessment, inquired about potential collaboration with NMCG.

Summit organisers welcomed further engagement and formally closed the 9th IWIS and 2nd CITIS, thanking the participants, organizing team, NMCG, Niti Aayog, and NRCD. Organisers assured that all feedback would be documented and encouraged continued engagement in policy, technology, engineering, implementation, and real projects.



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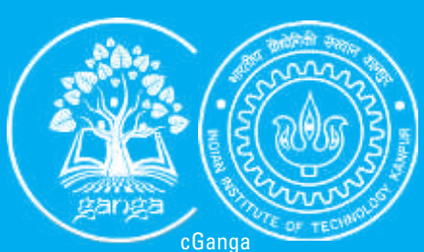

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