सत्यमेव जयते
Government of India

DECEMBER 10-15, 2020

(Virtual Mode)

Fifth India Water Impact Summit (IWIS)

Valuing Water | Transforming Ganga

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

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

A CONSOLIDATED REPORT ON

FIFTH
INDIA WATER IMPACT SUMMIT
(IWIS)

10-15th DECEMBER 2020

(VIRTUAL MODE)

MESSAGE

सत्यमेव जयते
राष्ट्रपति
भारत गणतंत्र
President
Republic of India

RAM NATH KOVIND

I am happy to learn that the National Mission for Clean Ganga and Centre for Ganga River Basin Management and Studies (cGanga) are organising the 5th India Water Impact Summit from 10-15 December, 2020 in virtual mode.

India is a river-based civilization and our many rivers and wetlands are vital natural assets that need to be preserved for our unfettered progress and cultural fulfillment. Since India's economic development is now accelerating, comprehensive river management will be a great boon for the country. Also, this summit will bring all stakeholders, national and international subject experts and others under a common platform to discuss, debate and develop model solutions for water related issues in the country.

I appreciate the effort of IWIS-2020 for promoting technological innovations and investments in river and water management in India and for fostering international cooperation between India and other countries — both developed and developing through dedicated tracks in IWIS-2020.

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

New Delhi
December 8th, 2020

(RAM NATH KOVIND)

MESSAGE

सत्यमेव जयते
उपराष्ट्रपति
भारत गणतंत्र

Vice President
Republic of India

M VENKAIAH NAIDU

India is blessed with a large number of rivers, lakes and wetlands which provide for the many needs of our lives, land productivity and industrial growth in almost every nook and corner of' the country. It is a fact that many of our rivers and water bodies leave degenerated over the past decades due to misuse and neglect. It is not often recognised, though, that this degeneration has had its adverse impact on India's development and welfare. Yet, things cannot continue indeflnitcly in this manner. It is time for us to reverse this trend and ensure that rivers become healthier, vibrant and contribute to India's rapid strides towards modernity, inclusive growth and healthy living. This change can come about not merely by a change in attitude, but with the added effort of critical analysis and by infusing modem knowledge and understanding.

I am pleased to learn that the 5th India Water Impact Summit — 2020 (IWIS-2020) is being organised jointly by the National Mission for Chan Ganga (NMCG) and the Centre for Ganga River Basin Management and Studies (cGanga) involving wide-ranging discussions with national and global experts, stakeholders and investors on holistic management of rivers and water bodies in India and also synchronising development with river conservation.

I am sure the Summit will provide an interactive platform between investors and stakeholders in the water sector and foster international cooperation between India and foreign countries. I wish the organisers of IWIS-2020 all success in their venture, and hope that the outcome of the Summit will prove invaluable in chalking out India's developmental path.

(M VENKAIAH NAIDU)

New Delhi
November 25th, 2020

MESSAGE

सत्यमेव जयते
प्रधान मंत्री
भारत सरकार

Prime Minister
Government of India

NARENDRA MODI

It is a pleasure to learn that National Mission for Clean Ganga is hosting the 5th India Water Impact Summit in the virtual mode. That the Summit aims to emphasize on holistic management of rivers and water bodies and synchronising development with river conservation is laudable.

Water of our rivers is a life-giving and life-sustaining force. Rivers have always been intrinsic to our socio-economic furtherance and cultural milieu.

Our Government has taken holistic measures with an integrated approach to ensure India's water security with conservation of our water resources and thriving bio-diversity.

From doing away with a compartmentalised approach in governance to focussing on comprehensive river conservation programme, from taking concrete steps to raise the ground water level and providing potable water to every household to making our development process holistic, sustainable and resilient, we accord utmost priority to ensure a water secure future for coming generations.

Our collective commitment towards river and water conservation is leading to encouraging results. For instance, various initiatives towards cleaning river Ganga are ensuring *swachhata*, *aviralta* and *nirmalta* of the river. Besides, we have also been focussing on the development of the environment and economy of the entire area adjacent to the river. Engagement of various stakeholders is constantly strengthening the endeavour.

May the discussions at the Summit come out with implementable roadmap to further the endeavour towards river conservation and help strengthen the people-led movement on water conservation.

Best wishes for all success of the 5th India Impact Water Summit.

New Delhi
December 5th, 2020

(NARENDRA MODI)

MESSAGE

सत्यमेव जयते

मंत्री
जल शक्ति
भारत सरकार

Minister
Jal Shakti
Government of India

GAJENDRA SINGH SHEKHAWAT

The 5th IWIS ("India Water Impact Summit — 2020") being organised jointly by National Mission for Clean Ganga (NMCG) and Centre for Ganga River Basin Management and Studies (cGanga), where many national and international experts, stakeholders and investors will deliberate upon holistic management of rivers and water bodies in India and also synchronising development with river conservation, with the vision of Arth Ganga, is highly welcome. At this juncture, our country faces the backlog of many unresolved problems, but we have the ability to turn adversity into opportunity and leapfrog over the pitfalls into a golden era for our nation.

One of the major problems that has been escalating for decades in India is that of water: both water shortages and water surpluses occurring periodically in various parts of the country have slackened our progress. Added to this problem are the high levels of pollution and poor state of many of our waterbodies, which have even limited the access of many of our citizens to clean water for personal needs. Needless to say, other problems like unmet irrigation, municipal and industrial water needs have also grown significantly. To meet these many challenges, our government began by successfully carrying out the *Swachh Bharat* programme to ensure universal household toilets throughout India. The *Namami Gange* programme, an Integrated Conservation Mission for Ganga and its tributaries, by following a basin-based and comprehensive approach covering both the aspects of water quality and quantity, is another step in this direction. We have now launched another ambitious programme of providing universal piped water supply to all rural households by the year 2024 under the Har Ghar Jal programme. This programme is even more challenging in that it involves ensuring — not only the rural water supply infrastructure — but also sustainable freshwater sources that can be tapped for years without affecting other freshwater needs. It is in this context that conservation of our rivers and waterbodies become even more pressing, and this conservation need is true for whatever river uses we have been making or will make in future.

I am pleased to note that the 5th IWIS will forge greater interaction between investors and stakeholders in the water sector and promote international cooperation between India and many foreign countries for water and river management. I wish the organisers of the 5th IWIS every success in this venture and hope to strengthen our programmes.

(GAJENDRA SINGH SHEKHAWAT)

New Delhi
December 7th, 2020

MESSAGE

सत्यमेव जयते

जल शक्ति और सामाजिक न्याय
एवं अधिकारिता राज्य मंत्री
भारत सरकार

Minister of State
for Jal Shakti and Social Justice & Empowerment
Government of India

SHRI RATTAN LAL KATARIA

I am pleased to learn that the Fifth "India Water Impact Summit" (IWIS-2020) is being organised jointly by the National Mission for Clean Ganga (NMCG) and the Centre for Ganga River Basin Management and Studies (cGanga) to deliberate over different aspects of "Arth Ganga" in India's development through extensive discussions by national and international experts, stakeholders and investors on synchronised river conservation and development. The Indian landscape is replete with rivers, lakes and waterbodies, but their distribution is uneven across the country. Their water-carrying potential also varies geographically and seasonally, making them a very dynamic and variable natural resource that calls for careful and judicious management. India's development story has not addressed this concern in its entirety, which has left large gaps in water availability and river utilization for national needs. Moreover, many waterbodies often get damaged by polluted waters, encroachments and other shortcomings of our developmental trajectory. Our government has, therefore, steadily focused on ensuring and on maximizing the sustainable use of river water for irrigation, navigation and other purposes.

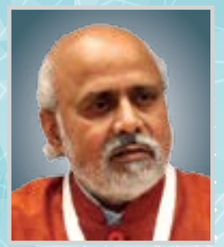
River is one of the crucial fresh water sources. It is important to protect and improve flows in the river valley systems. Rivers are not just the collection of water but a composite system of water, air, sediments, rocks, aquatic life, and plants providing a large number of ecosystem services. To take this understanding forward, Namami Gange program was launched by the Government in 2014. It is an umbrella initiative integrating the erstwhile and ongoing efforts with the aim of pollution abatement, conservation and rejuvenation of the River Ganga and its tributaries. The interventions are diverse ranging from pollution abatement measures for different sources of pollution - municipal waste water, industrial effluents, solid waste, rural sanitation, non-point sources etc. and also focus on conserving biodiversity, improving flow, protection of wetland and flood plains, restoring people - river connect by developing and improving ghats, public outreach etc. The towns and villages on the Ganga main stream have been comprehensively covered in the mission through a variety of interventions. Effective interventions under basin-approach have also been made on polluted stretches of the key tributaries of River Ganga such as Yamuna, Ramganga, Kali, Gomti, Saryu, Gandak, Ghaghara, Damodar, etc.

A critical assessment of the river water usage in different parts of the Ganga Basin in the context of national and regional development should, therefore, generate a slew of new ideas in IWIS-2020 that could help the government in formulating new policies and plan of action to bolster India's water strengths. I wholeheartedly wish NMCG and cGanga a very successful India Water Impact Summit-2020.

(SHRI RATTAN LAL KATARIA)

New Delhi
December 7th, 2020

Preface



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

RAJIV RANJAN MISHRA
Director General, NMCG
Ministry of Jal Shakti

THE ARTH GANGA CONCEPT,

a profound insight from ancient India, was invoked by the Hon'ble Prime Minister in the first Ganga Council Meeting, which laid the foundation of economic growth and river conservation conjointly in modern India through a synergistic approach between project planners, executers, financiers, investors and regulatory bodies

The National Mission for Clean Ganga (NMCG) and the Centre for Ganga River Basin Management and Studies (cGanga) sincerely thank all participants from India and abroad for making the fifth India Water Impact Summit (IWIS-2020) an all-round success. The Summit was notable for many innovative ideas and critical insights into the dynamic relationship between development and river conservation that underlies sustainable development in India – the inherent spirit of "Arth Ganga". The "Arth Ganga" concept, a profound insight from ancient India, was invoked by the Hon'ble Prime Minister in the first Ganga Council Meeting, which laid the foundation of economic growth and river conservation conjointly in modern India through a synergistic approach between project planners, executers, financiers, investors and regulatory bodies. IWIS-2020 endeavored to carry forward this concept in all its theoretical and practical ramifications by deliberating extensively on the interactions between key areas of India's developmental needs and the conservation of rivers and waterbodies. Parallel with these discussions, other sessions explored various aspects of water management and river conservation, as well as showcasing new technologies and innovations that can profoundly boost India's development and aquatic richness. The Summit was noteworthy for the spirited discussions among a wide spectrum of participants cutting across academic disciplines and fields of experience from India and the outside world.

India Water Impact Summit (IWIS) is now an annual event organized jointly by NMCG and cGanga. A brief overview of the past four Summits will help grasp the significance of IWIS-2020. The first Summit, held in 2012 when the Ganga River Basin Management Plan (GRBMP) was being prepared by the IIT Consortium, was an aggregate of the prevailing activities on India's water resource management at that time. The second Summit, held in 2017, attempted to establish a new multi-disciplinary, multi-stakeholder forum to bring together policy makers at national and regional levels, technology and engineering firms, finance and investment representatives, and interested civil society members to brainstorm and collaborate on pressing issues of India's water environment. The third Summit, held in 2018, reviewed the many efforts undertaken by government agencies to meet the government's goals of rejuvenation and conservation of India's National River Ganga (Ganges). The focus was largely on the most critical Ganga Basin States – Bihar, Delhi, Uttarakhand, Uttar Pradesh, and West Bengal – and what further needed to be done in those States in the light of GRBMP recommendations. The fourth IWIS in 2019 went further to explore ways and means of integrating science and policy for Integrated Water Resource Management, assessing and preparing for major water impacts in urban and rural areas of India, and developing new and innovative financing mechanisms through the Water Finance Forum initiated in IWIS-2017. The enthusiastic response of participants and the illuminating ideas and suggestions that emerged from the past Summits motivated us to probe deeper in IWIS-2020 – in the light of Arth Ganga, an initiative envisioned by the Hon'ble Prime Minister – to energize economic activity resulting from Ganga restoration and conservation, that is, the functional integration of river conservation with our developmental path and intensifying our efforts to meet the financial needs of water management and river conservation through a synergistic approach between project planners, executers, financiers, investors and regulatory bodies.

A developing country like India, that aspires to catch up speedily with the developed world in material terms, implicitly puts a premium on "development". Thus the immediate goals of development tend to override longer term concerns like environmental sustainability and social equity. An unfortunate consequence of this approach is that the health of many of India's rivers and waterbodies – like other critical ecosystems of the country – have deteriorated due to misuse or negligence. This has in turn affected our material progress as well as the social and personal wellbeing of the Indian populace at large. Hence, the need of the hour is to firmly link river conservation with development in order to earn long-term and more equitable benefits from the country's development. This notion is not new in India, and it is well encapsulated in the traditional concept of "Arth Ganga", which denotes the total value of River Ganga or of any other river that we can benefit from.

In light of the above IWIS-2020 focused on adopting the concept of Arth Ganga in India's developmental strategy. The first task in this strategy is to identify the developmental sectors that are closely linked to river functions and river values, the regions in a river basin where they are important, identify possible options and their linkages to river conservation, and evaluate the net value of development-plus-rivers for different developmental options in order to outline the preferred developmental path. Adopting the chosen path, however, would also need the synergistic participation of all (or most) stakeholders and suitable corrective measures from time to time while broadly following the chosen path. Hence the participatory role of small stakeholders – that is, apart from central, state and local body governments – also need to be decided and embedded in the developmental strategy along with appropriate monitoring and evaluation mechanisms. The suggested policies and measures resulting from these steps can then define the strategy in its completeness. These issues were deliberated in the Plenary and Thematic Sessions of the Summit on Science, Technology and Policy, both in the overall context and in the context of specific development sectors as outlined in the following paragraphs.

Among major developmental sectors in

A SPECIAL FEATURE

of the present Summit was to bring to fore the thrust and substance of some of the most important and potent international water partnerships with India to propel Indias journey in water and river management as well as to help other countries with Indias knowledge and experience in this field

India, that of human settlements is one that has significant impact on rivers and waterbodies, and the environment in general. Different land use and water use practices and other domestic, commercial, cultural and institutional activities in urban and rural settlements significantly impact river hydrology, water quality, geomorphology, biodiversity, and biogeochemical processes in their zone of influence. These impacts have consequent – and often cascading – effects on the larger river basin. The development of human habitats to suit immediate human needs – along with the changing patterns and magnitude of human activities – can thus have ever-new and increasing impacts on the rivers, whereby the goods and services provided by rivers diminish rapidly. Increasing urban floods in the rainy season as well as water scarcity in summer are two of the most obvious examples of such haphazard development in India. But there are other impacts too, some of which may be more injurious over the long term. Evolving a holistic strategy for habitat development along the lines outlined earlier is therefore a challenging task.

Increased energy generation capacity in India has also been given primacy by the government. The consequent rapid increase in hydropower projects in the last few decades in the Upper Ganga River and other upland rivers have had some negative impacts on the environment. Hence some restrictions were needed, based on holistic environmental impact analysis for a cluster of projects. Thermal (coal-based) power generation plants have also had noticeable impacts on rivers due to high-temperature discharges. Renewable energy projects other than hydropower are relatively few in the Ganga basin but are being vigorously promoted elsewhere. They hold out the promise of lower negative impacts on rivers and waterbodies. But, being relatively new in India, their actual impacts may not have been fully assessed yet, leaving room for speculative disorder and environmental damage. Energy demand management is also an area that needs to be improved. An in-depth assessment of the most suitable energy development and management methods vis-à-vis river conservation is therefore a pressing need, and adoption of the Arth Ganga framework can be highly rewarding.

Tourism is another economic sector whose development is being actively promoted. However, increasing tourism and ever-diversifying tourist activities are often closely linked with rivers. This is not only because rivers and riparian areas themselves attract tourists spontaneously, but also because pilgrimage and other sites of tourist interest are often located near rivers. Moreover, many such sites are located in eco-sensitive areas, especially in the geologically fragile Western Himalayas such as in Uttarakhand. The selection of appropriate tourism activities and associated infrastructure, therefore, needs to be strategically synchronized with river conservation.

Agriculture is, perhaps, the single most important development sector in the Ganga basin in terms of both economic output and livelihood. It is also an important area of interdependence with rivers and waterbodies. Many new developments in agricultural science and technology that have received acceptance globally are yet to take root in the Ganga basin. The impending transformations in agriculture are, therefore, a great opportunity to link river conservation with agricultural development to achieve a simultaneous high score on both fronts.

The governmental decision to develop the middle and lower Ganga stretches of the river as a national waterway suitable for large-scale commercial navigation is also likely to promote the development of many other arterial rivers of Ganga as commercial inland waterways. To what extent these efforts will improve or harm innate river processes will depend on the slew of changes, controls, interventions, and operational features adopted for these rivers from many possible alternatives plus the measures adopted for environmental protection – including the conservation of aquatic life and preventing river pollution from navigational activities. Experiences from both within India and the outside world will help evaluate the impacts to a large extent. Hence, adoption of the Arth Ganga framework can once again synchronize river conservation with navigation.

Finally, flood management is a critical issue in the lower parts of the Ganga basin where floods have become a recurring menace during monsoons, especially in Bihar, West Bengal and Eastern Uttar Pradesh. Flood management is not truly a development activity, but it is one that controls, and even strangles, development on many fronts. Besides, various flood management techniques can be variously beneficial or harmful for rivers and waterbodies, and vice versa. Hence integration of flood management with river conservation is an obvious imperative at present.

Enormous financial resources (estimated earlier at about Rs. 5 lakh crores or $100bn) are needed to restore National River Ganga to its former unpolluted state and to upgrade water infrastructure in the country. This is a daunting task for the country. To find ways and means to meet this goal, the Summit discussed appropriate models to finance the circular economy with several case studies, strengthening of the Hybrid Annuity Model and PPP models for the water and wastewater sector, ways to finance the commercialization of new technologies and innovations, developing capital markets for water sector financing, adopting innovative financial and guarantee instruments such as insurance wrappers and credit enhancement instruments, and other financial options.

As in the past Summits, IWIS-2020 also showcased some of the most promising new technologies and innovations waiting to enter the Indian water space. Among these, data management has acquired great importance for water as in many other spheres of Indian science and industry, and some of the innovations presented focused on the use of digital information in the water sector. Several other physical and conceptual innovations in water applications were also presented.

A special feature of the present Summit was to bring to fore the thrust and substance of some of the most important and potent international water partnerships with India to propel India's journey in water and river management as well as to help other countries with India's knowledge and experience in this field. These sessions highlighted the key features of such partnerships involving the developed countries of Europe and America as well as developing countries of South-East Asia.

In concluding, we wish to thank the Government of India and our strategic partners, panelists, speakers, sponsors, staff and volunteers whose faith and hard work were crucial in making this Summit a success. With the remarkable achievements of IWIS-2020 for evidence-based knowledge inputs and the continuing support of our national and international partners and well-wishers, we are re-energized to carry on with our efforts for river restoration and comprehensive management of India's aquatic resources and water infrastructure. We hope that the experience of the Summit has been no less rewarding for the participants and all our partners.

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TRACK B

FINANCE AND ECONOMICS

TRACK C

TECHNOLOGY AND INNOVATION

TRACK D

INTERNATIONAL PARTNERSHIP

Inaugural Session:
"Comprehensive Analysis and Holistic Management of Local Rivers and Waterbodies" with focus on "Arth Ganga: River Conservation Synchronised Development"

DAY 1:
Thursday; December 10, 2020
11:00 – 12:45 hrs

MODE:
Virtual

CHAIR:
Vinod Tare [Founding Head, cGanga, IIT Kanpur]
Rajiv Ranjan Mishra [DG, NMCG]

CHIEF GUEST:
Gajendra Singh Shekhawat [Hon'ble Minister, Jal Shakti, GoI]

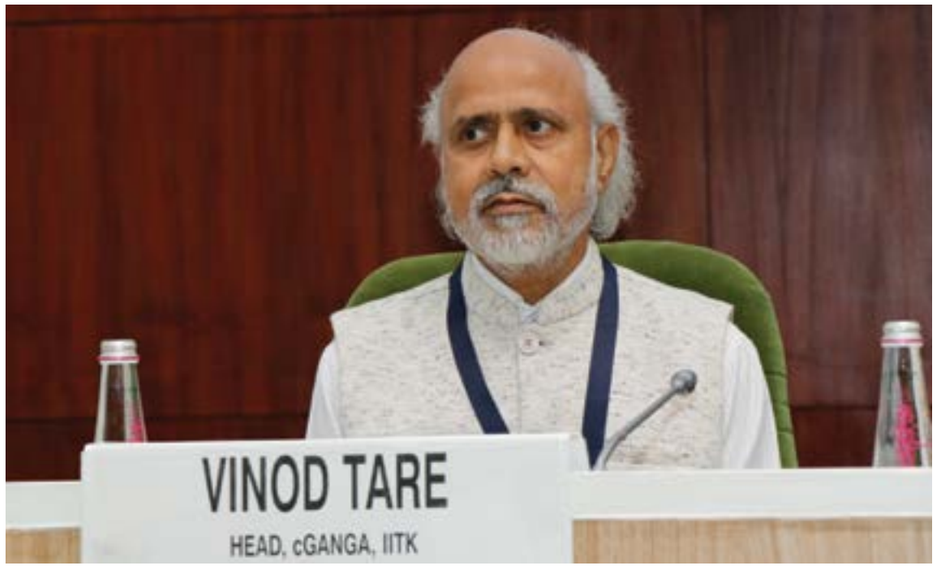
GUEST OF HONOUR:
Rattan Lal Kataria [Hon'ble Minister of State, Jal Shakti, GoI]

INVITED SPEAKERS:
UP Singh [Secretary, Jal Shakti]

Rajiv Ranjan Mishra, DG, NMCG

- River Ganga represents in a way all the rivers and all the water in our country, and it's very important to initiate certain things in river Ganga and carry it forward to the other rivers and other ecosystems.
- The 'Namami Gange' program is not just a cleaning program, it also includes "Aviral Ganga" to improve the river flow and river ecology. There is also a strong component for connecting people with Ganga – the "Jan Ganga" movement – and today we are working on our last major vertical – "Gyan Ganga" – where we deliberate upon and try to improve our knowledge of Ganga from the experience of others.

Vinod Tare, Founding Head - cGanga



- The Hon'ble Prime Minister floated the idea of Arth Ganga, which is essentially to consider river conservation and development as two sides of the same coin and not two opposing approaches of "development" and "Ganga river conservation".
- River conservation is measured on the scale of river health, that is how good the river is. While development is measured on a scale of economy or GDP, and whether it is sustainable or not that is important. The Arth Ganga concept brings together both the health of the river as well as sustainability of the activities.
- Ganga represents the culture of rivers in India since Ganga symbolises all rivers. Arth means the spirit, and it also means its economics. Together it is "Arth Ganga". cGanga as a knowledge partner of NMCG tries to realize our Prime Minister's vision on the ground. And this vision can be realized on the ground only when we work on each and every component of the river. Hence the focus of this IWIS Summit is on holistic management and comprehensive analysis of all rivers, local rivers particularly, and including waterbodies such as lakes, reservoirs, wetlands, and groundwater.
- The Prime Minister also gave the slogan of 'Vocal for Local'. This phrase 'Vocal for Local' is going to contribute significantly in containing climate change because we will learn how to work with local people, how to make sure that we utilize local things and develop economy at the local scale, utilizing this concept of river conservation. So, it is very important to understand that Arth Ganga, 'Vocal for Local', 'Make in India', and 'Start-up India', are all related to river conservation, and the economy can grow synergistically around, which will be discussed in the Finance and Economics session. It is also important to prepare framework and develop methodologies to demonstrate how GDP contribution can be actually calculated for each of the major sectors which are affected by river conservation – agriculture, energy, tourism, navigation, etc. But what we are looking at is when we conserve river, how do we make sure that the efforts made for conserving rivers are assessed in terms of contribution to the economy and adds to the local as well as global GDP.

THE ARTH GANGA
concept brings together both the health of the river as well as sustainability of the activities. Arth means the spirit, and it also means its economics. Together it is Arth Ganga.

Inaugural Session: "Comprehensive Analysis and Holistic Management of Local Rivers and Waterbodies" with focus on "Arth Ganga: River Conservation Synchronised Development"

UP Singh, Secretary, Ministry of Jal Shakti, GoI

- How to bring back water to the river, we must work towards that. We have to improve our water-use efficiency. The water which we are consuming in agriculture is two-and-a-half time more than what should be used. We are using 2 to 3 times more water in our household than required.
- In Haryana discussions take place on pollution in River Yamuna, on pollution in River Ghaggar, etc. Haryana has more capacity to treat the total sewage generated. What is referred as Drain 2 in Haryana, is not really a drain to carry sewage, actually it is an escape channel. But wastewater from the Panipat Drain falls into it. With so much STP/CETP capacity created in Hrayana, why is Panipat Drain not meeting the standards?
- Elimination of Black Liquor from Paper Industry: The consumption of water is now reduced by half for per tonne production of paper than the water utilised earlier. There is also one advantage that the industrial effluent generation is also reduced by half, but we still do not compare with the best in the world – whether it is consumption of water per tonne of steel production or per unit of electricity-generation than what is required. So, there is so much scope for water conservation – on both supply-side as well as demand-side.
- There are 5 "R"s of importance in regard to water – 'Recycle', 'Reuse', 'Reduce', 'Recharge' (of groundwater), and the most important– 'Respect' for water.
- If we can really take care of rivers, a lot of activities can be generated along the river as in foreign countries – 'Cycle tracks', 'Small huts' for families to stay overnight on holiday. There could be a thousand such places actually, not just in Haridwar or Rishikesh or Varanasi.

Rattan Lal Kataria, Hon'ble Minister of State, Ministry of Jal Shakti, GoI

- This year, the Summit will look into the complexities and means of managing our rivers, local rivers and waterbodies keeping in view our developmental needs, which will be helpful in synchronizing conservation of rivers with development from a broad point view.
- Under the "Namami Gange" programme – whose results also are becoming amply visible – we are treating domestic and industrial effluent, as well as implementing projects on biodiversity conservation of river Ganga and renovating "ghats" and "crematoria" to connect the general public with Ganga, and ensuring peoples' participation to realise the concept of "Jan Ganga".
- Learning from the results of Gange Action Plan, 'Namami Gange' has been structured on the basis of scientific studies, taking a long-term vision. For the first time, Hybrid Annuity Mode in PPP has been introduced under which we are ensuring that STPs are not only constructed but will also work effectively during their fifteen-year life-cycle.
- Moving away from previous efforts, the 'Namami Gange' Mission is not only limited to a few big cities, but work is being done in 97 cities situated on the banks of Ganga. Cleaning programmes have also been undertaken in the villages. Cleaning and all-round development programmes are being run in more than 40 "Ganga Grams" situated on the bank of Ganga.

'NAMAMI GANGE'
has been structured on the basis of scientific studies, taking a long-term vision

Inaugural Session: "Comprehensive Analysis and Holistic Management of Local Rivers and Waterbodies" with focus on "Arth Ganga: River Conservation Synchronised Development"

Gajendra Singh Shekhawat, Hon'ble Minister, Jal Shakti Ministry, GoI

A 20 MLD TREATMENT

plant for tannery effluents and have brought on board the industry associations through the creation of a Special Purpose Vehicle to ensure the polluters pay principle

- The northern region of the Indian sub-continent, known as the Indo-Gangetic plains, is considered the best agricultural land in the world. It is a valuable gift of the Ganga and its tributaries.
- Our government is committed to establish an ecosystem whereby economic development can go hand-in-hand with ecological conservation. We are ensuring the required balance between the two and focusing on development synchronized with river conservation.
- In many big cities, we have undertaken city-wide projects on "one city, one operator" principle to improve the sewage treatment system and its operation and maintenance for the whole city. This has increased the management capacity and accountability in running new and old plants together in the entire city.
- We have also undertaken the construction of 38 Sewage Treatment Plants of almost 2600 MLD treatment capacity at a cost of about Rs. 8000 crores on the tributaries of Ganga like Yamuna, Ramganga, Kali, Kosi, Saryu, Gomti and other rivers.
- A total of 1109 industries along the banks of Ganga that are responsible for pollution has been identified, and a protocol is being set up for annual inspection of all these industries by independent institutions. Technical progress has also been achieved to reduce pollution from these industries. Zero black liquor discharge in rivers from the Pulp & Paper industry is also being successfully achieved.
- For a major problem in the middle stretch of River Ganga, we have sanctioned a 20 MLD treatment plant for tannery effluents and have brought on board the industry associations through the creation of a Special Purpose Vehicle to ensure the "polluters pay" principle.
- For IWIS-2020 we have involved the Indian Missions and strategic foreign countries active in the water sector: UK for Climate Change and COP-26, US for Digital Water, EU for multiple innovations in the environmental sector related to water, energy and land, Norway for circular economy, and the lower Mekong nations to strengthen the Ganga-Mekong Partnership.
- The river Ganga is not only a source or carrier of water for us, it's a part of our lives, our culture and our heritage, connected with various activities and festivals. That is why we have actively been developing Ghats, Crematoriums and Riverfronts.

Arth Ganga – River Conservation Synchronized Human Settlement

DAY 2:
Friday, December 11, 2020
12:00 – 13:30 hrs

MODE:
Virtual

CHAIR:
Vinod Tare [Founding Head, cGanga, IIT Kanpur]
Rajiv Ranjan Mishra [DG, NMCG]

KEYNOTE ADDRESS:
Amitabh Kant [CEO, NITI Aayog, GoI]
Kees Bons [Deltares, NL]

Vinod Tare, Founding Head - cGanga

- When we consider conservation of rivers and economic activity, there are a number of sectors which are dependent on each other. Thus, river conservation is dependent on human settlement, and human settlement is dependent on river conservation. This is the reason for considering them as two sides of the same coin.
- River conservation should be looked at as an important economic activity. Just as we have road infrastructure, electricity infrastructure and many other services that we provide in human settlements which are looked upon as economic activities, so also water supplies, sanitation, drainage, and solid waste management are important economic activities from the point of view of river conservation.
- River restoration and conservation is not only science and technology, but also involves policy and governance. That is the reason to have set up National Mission for Clean Ganga as an apex body to revive River Ganga. Eventually we should aspire to take the concept of river basin authorities to small rivers and their basins for a bottom-up approach to river conservation.
- River culture has to be imbibed into every person. And once we do that, everybody will take pride in them and ensure that the rivers and water bodies become our front yard rather than our backyard. But, Rivers Yamuna and Ganga, or any pond or waterbody for that matter, being our pride, we have not allowed their degradation.
- We need to plan human settlements in such a fashion that the river becomes the focus, and then the Urban Planning will be in sync with River Management Plans.
- The concept of Arth Ganga is a very effective tool for communicating the need to conserve rivers that calls for vision and patience. Ultimately rivers impact economy and livelihood together.

Rajiv Ranjan Mishra, DG, NMCG

- We are more urban than what our figures indicate because there are several villages which have urban characteristics. Haryana has actually started developing lots of programs for villages, looking at pollution and other environmental problems. We have to look at how these problems are not repeated, and that is where urban planning become very important
- For urban centres, we must look at both Integrated River Basin approach and Urban Water Management approach, and integrate them in the master plans. Several cities' master plans are under revision, and if we don't have river sensitive urban planning then many problems will keep on repeating. The example of Chennai very clearly shows that water shortage is there and urban flooding is also there, and the solution is nature-based. But we have been encroaching upon urban wetlands, and these wetlands could have been a natural solution for water management, for pollution, for tourism, for biodiversity. That is why we need to look at developing every good approach and training city managers and sensitizing them.
- Floodplains cannot be dustbins of cities. A very simple example is in Patna where we developed a 500 km long promenade along the river, and now we see the difference between the behaviour of people. People go there for walks, for yoga, and for studies. So there is a connection with rivers which improves over time.
- We have to consider how exactly there could be a way of incentivizing reuse, to promote the reuse of treated wastewater or other things in the city, so that we don't have to dump solid waste and there is some way to process and some way to reuse and then convert them into useful things.
- There is need to sensitize the students at various stages also, whether they are in planning schools or engineering colleges or schools. We will have to sensitise them to look at natural ecosystems in more holistic ways.
- We have to look at the city as a whole and then what kind of water flow comes into the city, what kind of rain water comes, what we do with that water, how we actually manage that. This will be in conformity with the theme of this conference focused upon local rivers and local solutions.
- River basins are on large scales, but if we limit our attention to three or four cities, some sort of regional management is possible. So we are trying to initiate a kind of dialogue with stakeholders and develop, at least in the case of Ganga, some sort of river city alliances so that we can learn best practices from each other.

Arth Ganga – River Conservation Synchronized Human Settlement

Amitabh Kant, CEO, NITI Aayog

- Rivers – particularly in India – are a symbol of faith, hope, culture and sanity as well as a source of livelihood for millions since time immemorial. Respect for rivers was part of Indian identity and the very symbol of Indian culture. Rivers add to the value of human lives by catering to various needs including freshwater needs, hydro-electricity generation, irrigation, transportation, recreation, tourism, etc.
- It is difficult to understand the intertwining relationship between humans and rivers that have always played an important role in the development of human civilization. But even when rivers act as supporting lifelines of people, human beings are destroying these lines by polluting them, encroaching upon the room of the river, and destroying river corridors.
- Human alterations often begin with changes in land cover, which alter the water and sediment regimes and destroy watersheds of the region.
- In India, according to a United Nations estimate, 80% of the contaminated water is being dumped in the two main tributaries of the Ganga river.
- In the last few summers, the Ganga has witnessed unprecedented low levels of water in several lower reaches, and for the next thirty years groundwater contribution to the river will decrease further. This is a matter of great concern.
- 'Namami Gange', launched in June 2015, integrating previous and currently ongoing initiative in a holistic manner with a basin approach, covers various interventions including sewage infrastructure projects, rural sanitation projects, industrial pollution-abatement works, "ghats" and "crematoria" development projects, river surface cleaning projects, biodiversity conservation projects, afforestation projects and public participation projects. Several projects have been completed and made operational, and rest are at various stages of implementation. But to transform Ganga, much more work needs to be done by all of us as a team.
- We must not tamper with the flow of rivers and we should not put any garbage into it, else it is necessary to realize and accept the amount of damage human intervention is causing. The key to this change requires huge community participation – we have to introspect our own activities and change them.
- In the words of a famous editorial environmentalist, choosing to save a river is more often an act of passion then of careful calculation.

WE SHOULD

aspire to take the concept of river basin authorities to small rivers and their basins for a bottom-up approach to river conservation

Arth Ganga – River Conservation Synchronized Human Settlement

Kees Bons, Deltares, NL

THERE ARE MANY
potential JOBS PER DROP of water; so planning employment opportunities in settlements will make both urban and rural sectors more effective and efficient

- Human settlements generally impact rivers in three ways: they change the natural flow of water by constructions; river water extraction and/or diversion into canals; and they produce solid and liquid wastes that pollute rivers. On the other hand, rivers provide a lot of value to humans. In terms of river ecosystem services, these include "Provisioning Services" like food, water, etc., "Supporting Services" like nutrient cycling, soil formation, and habitat protection, "Regulating Services" like climate regulation, flood regulation, water purification, etc., and "Cultural Services" like spiritual, aesthetic, educational, and recreational activities. This is a good way to quantify river values and sensitise the term 'Arth Ganga'.
- There are three points of consideration in planning: (i) Do not look only at the present gap or present problems, since there will be doubling of the population within the planning horizon. (ii) Unofficial colonies in cities will also grow and get included in official planning for water supply and sewerage. (iii) There are many potential JOBS PER DROP of water; so planning employment opportunities in settlements will make both urban and rural sectors more effective and efficient.
- Consider the example of Chennai, which manages its water at the moment using faraway reservoirs, desalination plants, etc., while most of the rainwater in Chennai goes to the sea and a lot of dirty city water also flows into the sea. However, by using mainly local rainfall to fulfil local needs and a closed system of water treatment and recycling, the groundwater will remain clean, clean water will flow to the sea, and there will be enough water for urban use all year round.
- We must start to think nature-based solutions and look at different targets like flood prevention, sanitation and improved urban environment in an integrated manner.
- Law enforcement is a very poor and low policy tool. There are many alternatives. So planning technical or infrastructural solutions is not enough, incentives that influence behaviour are essential policy instruments; because prevention is much cheaper than treatment.
- Implementation of plans is critical and needs three changes in approach. One is by giving water rights to everyone including the right to buy and sell surplus water – this will generate a lot of awareness about the value of water. Second is the realistic pricing of water and recycled water so that consumers get incentivised to save money by saving water. The third change is to base levies and taxes on pollutant loads (not pollutant concentrations), in addition to penalties, if acceptable pollutant limits are exceeded. This will incentivize consumers, especially industries, to reduce pollution and treat wastewaters themselves.

Arth Ganga – River Conservation Synchronised Energy and Tourism

DAY 3:
Saturday, December 12, 2020
12:00 – 13:30 hrs

MODE:
Virtual

CHAIR:
Vinod Tare [Founding Head, cGanga, IIT Kanpur]
Rajiv Ranjan Mishra [DG, NMCG]

CHIEF GUEST:
Trivendra Singh Rawat
[Chief Minister, Uttarakhand]

GUEST OF HONOUR:
Prahalad Singh Patel [Minister of State (I/C), Tourism]

KEYNOTE ADDRESS:
Ajay Mathur [Director General, TERI]

Vinod Tare, Founding Head - cGanga

- Ganga is a symbol of all rivers for us – Ganga is the culture of the rivers of India. We look at all rivers with the same vision and give due respect, and all the rivers in a basin have to be restored and conserved from the point of view of Ganga, this is the main goal of Namami Gange and this is what we are impressing upon in this summit.

Rajiv Ranjan Mishra, DG, NMCG

- In our internet project, we have started mapping the entire heritage of Ganga in which, along with natural beauty, the built heritage such as architectural forts and temples are included. There are also intangible heritages on the banks of the Ganges, such as painting and music, all of which are to be covered in heritage mapping.
- A few years ago, Ganga Sanskriti Yatra was started. This time also we plan to start it around May-June subject to the Covid pandemic situation.
- Our vision for tourism and culture development ensures keeping the environment safe, which is the carrying capacity of the place.
- As far as energy development is concerned, the continuity of the flow of Ganga is non-negotiable. There are 3 types of connectivity to be maintained in the river: longitudinal connectivity, which is ruptured by structures across the span of the river; lateral connectivity which concerns our floodplains, which must not be encroached so that the floodplain wetlands are recharged; and vertical connectivity which is connectivity to maintain the groundwater and waste flow relation.
- Under the leadership of the Hon'ble Prime Minister, we have given the historical right of a river over its water to maintain its ecology. We will know later in technical detail about the overall impact of hydroelectric projects and in what way to design them so that they have the least impact on the environment.
- We request the Ministry of Tourism and Culture to make Ganga galleries in national museums near the Ganga river. The first Ganga museum was built over Chandi Ghat in Haridwar, which was inaugurated by the Hon'ble Prime Minister.

Arth Ganga – River Conservation Synchronised Energy and Tourism

Trivendra Singh Rawat, Hon'ble Chief Minister, Uttarakhand

- When we talk about River Ganga, there are hundreds of small Ganga rivers which together form Ganga-ji and there are many tributaries which further join Ganga-ji, and they all together become Ganga. This is the most prominent feature of Indian culture, and that is why we say that the culture of Ganga is the culture of India.
- Uttarakhand lives in the lap of the high Himalayas, where innumerable sages discoursed their wisdom that later become our laws like the Forest Act. Indian culture is founded on the culture of these saints and sages.
- Be it from the point of view of tourism, of agriculture, of energy, or of forestry, Ganga has such enormous potential that it can easily contribute 3% to the nation's GDP. The concept of 'Arth Ganga' invoked by the Prime Minister is a big contribution to strengthen the economy of India.
- In Uttarakhand we are making lakes to harvest and store rain water in all districts to feed our rivers because, so long as water keeps flowing in them, the Ganga and other rivers will remain pure and uninterrupted. Some lakes in Nainital had also dried up, so we have drawn up a plan to revive the lakes.

Ajay Mathur, Director General, TERI

- Hydropower projects and dams do generate electricity, control floods, and send water for irrigation. But they also create problems. If we develop hydropower without adequate thinking, then the development of the area and the tourism of the area are affected, and they do not benefit on the whole.
- Many hydropower projects have been built in Uttarakhand, but the villages next to them did not get electricity for a long time because it was not an easy task to take electricity from the power station to that village. Planning local development needs must therefore be integral to hydropower projects.
- Most of our religious places are ancient. A major problem with hydropower projects' site selection is that when hydropower projects are made, religious sites get submerged. We must see how to raise such religious institutions to a safe height before water starts filling up the reservoir.
- We have excellent programs for engineering design of hydroelectric projects. But we forget the geographical location and the people who live there. We should not forget the local culture and keep energy development in the forefront of our projects. There is a need to create a Geographical Development Authority for these places, keeping the local culture and geography in forefront, even if you call it Tourism-Hydropower Development Authority.
- In many tourist areas of Uttarakhand, tourists use 10 to 15 times more water in comparison to local people, which stresses local water resources during peak tourist seasons. In such places water conservation is as much needed as energy conservation, in which area we have achieved a fair amount of success. Similar success can also be achieved in water conservation, but it is necessary that there be a Water Authority to oversee water availability, use and conservation in tourist hotels.

Arth Ganga – River Conservation Synchronised Energy and Tourism

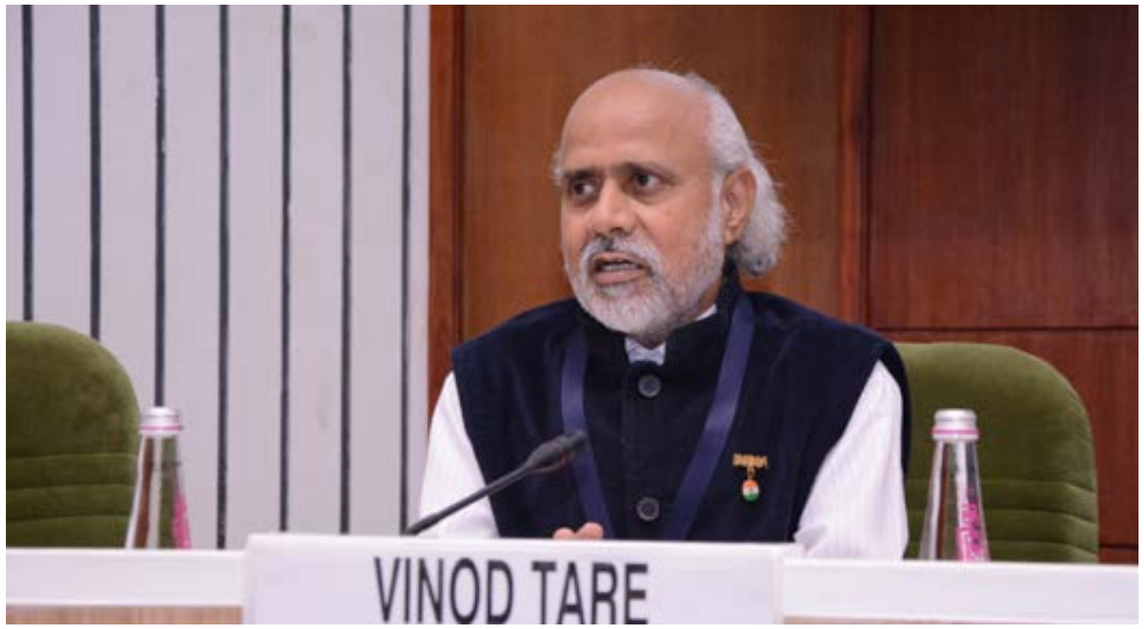
Prahlad Singh Patel, Hon'ble Minister of State (I/C), Tourism

- I have travelled the entire length of River Narmada on foot; rivers should not be allowed to become canals.
- This is an initial effort. We have to think not only about Ganga but about all our seven rivers because river culture represents the whole country, this should also be our message to the nation.
- Whether it is tourism, or nature or energy, even if we consider culture by combining all three, then none is possible without rivers. I believe that river is the creation of God, perhaps the greatest creation, with the help of which we have strengthened our culture for hundreds of thousands of years.
- I find it very strange that whenever big people discuss rivers, I hear them talk only about river cleaning, not its flow. But what is the real source of energy of the river? The Ganga originates from a glacier but the Narmada does not come out of the glacier, even then its flow is continuous.
- The river energy that I talk about is spiritual energy. When you sit on the bank of a river, its vibrations, its tone gives you a natural energy.
- The source of dirt and pollution in rivers today are institutional, not from individuals. We should pay attention to the institutional mistakes. Making Treatment Plants can definitely be a solution, but we have to change our working style. Is it necessary that dirty water should be discharged in the river, no matter how much we purify it?
- Unless there is tourism, one cannot see things with complete transparency. Tourism is not an empty pleasure, it is also a journey to gain knowledge.
- The forthcoming Kumbh Mela is in Haridwar. Let us decide before this Kumbh – because Kumbh is also a medium of discussion – that river energy and riverside tourism are synonymous with each other, you cannot separate them if there is to be any tourism. Along the river, people have done tourism by boat, some have done it on foot, some have done it by other means. And this is the basis of seeing how our cultural values grow on the banks of rivers and sadhus do spiritual practices. How to receive energy should be the goal this time.
- Our respected Prime Minister said that rivers are the backbone of cultural uplift. If our culture is big then the banks of the river are also big, we work to save them. Cleanliness of the river is very important, it is necessary that we find the solution.

UNLESS THERE IS
tourism, one cannot see things with complete transparency. Tourism is not an empty pleasure, it is also a journey to gain knowledge

Arth Ganga – River Conservation Synchronised Agriculture

Vinod Tare, Founding Head - cGanga



Rajiv Ranjan Mishra, DG, NMCG

DAY 5:
Monday, December 14, 2020
12:00 – 13:30 hrs

MODE:
Virtual

CHAIR:
Vinod Tare [Founding Head, cGanga, IIT Kanpur]
Rajiv Ranjan Mishra [DG, NMCG]

KEYNOTE ADDRESS:
Alka Bhargava [Additional Secretary, DAC&FW]
Neelam Patel [Sr Adviser, Agriculture, NITI Aayog]

- River conservation alone cannot be sustainable, it has to be linked to our economy. So development and river conservation have to go hand in hand. If you conserve rivers it feeds into the sustainability of development, and if we develop that allows us the luxury of spending money for river conservation purposes. They are complementary to each other.
- River conservation can happen in a sustainable way only when they start from local rivers, from local water bodies, while policy perspective, knowledge creation and guiding approach can be top down.
- There are reports on water pollution due to fertilizers and pesticides. But do we know what is the flow coming from agriculture? What is the quality of that flow? What kind of pollution is it bringing? Similar to the case for industrial effluents, that kind of quantification is one of the major challenges before us and before the technical community.
- We have notified environmental flows for the first time, trying to recognize the right of river over its own water. But our E-Flow notification, apart from specifying how much will be released in monsoon period and non monsoon period from different barrages, also very clearly talks about demand side management, and that is where agriculture becomes very important. To ensure the health of rivers we will have to improve water use efficiency in agriculture.

Arth Ganga – River Conservation Synchronized Human Settlement

Alka Bhargava, Additional Secretary, DAC&FW

- In 2016, we considered 1657 Gram Panchayats in the five Ganga states for organic farming and micro irrigation that is for water conservation measures. But then we also expanded our ambit of work to make it more of a market driven concept, because only then will the farmers be able to justify their efforts, their production, etc. Around those clusters where organic farming was promoted, we are adding horticulture, agroforestry, good water conservation practices (not just micro irrigation), changing cropping patterns, and crop diversification.
- We are propagating a balanced use of fertilizers through integrated nutrient management that is, even if you're using chemical fertilizers, they have to be in the ideal proportion. And now for this Ganga states, we are trying to wean farmers off from chemical farming to organic.
- To bring traditional wisdom and modern science together, there is a huge scope for floriculture and nutri-cereals like millets which need to be brought back to our plate.
- We have to sell the idea of more crop per drop to farmers including improved practices specially for SRI and DSR. It is about increasing productivity, because once you use sprinkler or micro irrigation, the labour cost and fertilizer consumption go down. So the input cost is reduced while productivity increases by 40 to 60 percent depending on the various crops.
- We're also working with MNRE to put in more solar pumps so that there is less pressure on the traditional electricity and power supply, and also whatever surplus the farmers generate, they can give it back to the grid. So it is a kind of incentive also to draw less water to use the solar panels less.
- We're also introducing climate-resilient varieties, both drought tolerant and flood tolerant.
- The new program, Govardhan, which has been launched by the Department of Drinking Water and Sanitation, is setting up a lot of compressed biogas plants. Both crop residues as well as cow-dung are used for generation of bio-fuel and with bio-fertilizer as a byproduct.

ARTH GANGA IS

a holistic concept that strikes a balance between economics and ecology. We have to harness our economic potential keeping biodiversity at the forefront, otherwise ecological damage will result in permanent loss in ecological economic balance

Neelam Patel, Sr Adviser, Agriculture, NITI Aayog

- More than 60 percent of India's farmers are small and marginal category who cannot bear high input costs. In Mission Ganga farmlands within 5 to 7 km will be covered under natural farming and organic farming to reduce the input cost.
- We have to shift from monoculture to diversification and value addition from the farm gate to the market. To decrease the wastage of food products we also have to have processing facilities at block and village levels, not at the city level.
- We are having more than 100 million hectares under irrigation, but to have nutritional security we have to have about 160 million hectares by 2025, and by that time the water available for agriculture will be between 63 to 83 percent. So, the challenge will be to produce more using the less quantity of water.
- We are depleting our natural resources, particularly water and soil, because of which the agriculture business is not sustainable. In comparison with US and China our water use efficiency is very low in growing rice, wheat and soybean, which are major crops in the Ganga basin. This handicap can be overcome by adopting micro irrigation and improved water conveyance systems.
- We have to make our agriculture climatically resilient to solve and increase the productivity while maintaining the soil health.
- 'Arth Ganga' is a holistic concept that strikes a balance between economics and ecology. We have to harness our economic potential keeping biodiversity at the forefront, otherwise ecological damage will result in increasing imbalance between ecology and economy. Hence sustainability must be at the forefront of the policymaking efforts, and promoting sustainable water use must be accorded priority.
- At the start of the Green Revolution in 1669 1 kg of NPK increased 12.1 kg grain production, but now 1 kg of NPK produce only 5 kg of grain. The response to fertilizers has become very poor as our soils are deficient in micronutrients and the NPK ratio in actual use may not be ideal. In the north zone, we are applying NPK in the ratio 19.7:5.6 :1 instead of 4:2:1.
- In natural farming we see soil as a living entity, indigenous cow-based system, mulching with crop residues, earthworms and microbes play key roles in soil health. Use of renewable energy, conservation of soil and water, use of homemade formulations, intercropping, and crop diversity are some of the indicators of natural farming becoming sustainable.
- Technological innovations include the use of isotopes to quantify the movement of nitrates using soil sensors and weather data leveraging IoT, ensure quality certification and facility using blockchain technology for green products, promoting local and Indian 'super foods' like Amaranth (vs Quinoa), buckwheat (vs oats), beet greens (vs kale) to make agriculture more sustainable under the Mission Ganga program.

Arth Ganga – River Conservation Synchronised Inland Water Navigation and Flood Management

DAY 6:
Tuesday, December 15, 2020
12:00 – 13:30 hrs

MODE:
Virtual

CHAIR:
Vinod Tare [Founding Head, cGanga, IIT Kanpur]
Rozy Agarwal [ED (Finance), NMCG]

CHIEF GUEST:
Vijay Kumar Chaudhary [Hon'ble Minister, Water Resources, Govt of Bihar]

KEYNOTE ADDRESS:
Kees Bons [Deltares, NL]
SK Gangwar [Member (Technical), IWAI]
Ruchi Badola [Scientist G, WII]

Vinod Tare, Founding Head - cGanga

- The IWIS discussions this morning showed that it is very much possible to achieve all our goals together – navigation, river conservation and flood management.

Rozy Agarwal, ED (Finance), NMCG

- As part of the Arth Ganga concept NMCG is trying to develop sustainable economic model along the banks of river Ganga which includes major interventions like sustainable agriculture, agroforestry, promotion of clean energy, and navigation along River Ganga.
- It is important that river ecology is conserved and side by side economic activities taken up along the banks of river Ganga. It is also important to consider the conservation of river biodiversity – conservation and protection of aquatic flora and fauna – which is an indicator of the health of River Ganga.

THE CONCEPT OF room for the river does not mean that we retract and just leave the space for the river to use as it wishes; it means that we manage the space in such a way that the river can use it when the river needs it and we use it when we need it

Arth Ganga – River Conservation Synchronised Inland Water Navigation and Flood Management

Vijay Kumar Chaudhary, Hon'ble Minister, Water Resources, Govt of Bihar

- The three issues of this summit session – river conservation, water navigation and flood management – are the most important and relevant for the geographical region of Bihar. The misery of the lower riparian state of Bihar is that it cannot overcome the problems at its own level or on its own initiative until the cooperation of all people is available from top to bottom.
- Almost all rivers that flood North Bihar are rivers coming from Nepal. So the management of those rivers becomes an international subject. Flood moderation from these rivers, especially the Gandak or the Kamla Kosi rivers coming from Nepal, was envisaged by construction of high-level dams. A plan was made for the construction of a high-level dam in Badhao area of Kosi, but no dam came up. There are floods also in Kamala and in Bagmati Noon. Suitable locations for the construction of different high-level dams were identified, but no concrete progress has been made since then. Hence we have to face floods every year.
- Inter-linking of rivers was also considered. We first had the link plan of old Gandak Noon Bayag. After a long time we were told to modify the scheme, and after that nothing has happened. After another 10-12 years, a plan has now been made for a Kosi Mechi link.
- All the three topics of today's session – river protection, water, navigation and flood management – have at their root only one thing which is silt management.
- If the flow of the river is centralized, then the river will be protected, inland water transportation can also be effective, and floods can also be managed. The geographical location of Bihar is such that sometimes we suffer both floods and droughts together. The biggest task to tackle these problems is a silt management policy to channelize rivers. Silt accumulates in the rivers till Farakka, where silt flushing is almost dysfunctional, increasing the rate of upstream silt deposition.
- A national Silt Management Policy must be made so that we execute an action plan for silt management from the beginning, only then will the flow of rivers remain centralized, and only then the rivers will survive.
- The Bihar Government has started the Jal Jeevan Hariyali program. There are different components in it, including the conservation of waterbodies and of green areas, rainwater harvesting, and various other things.
- At its entrance in Bihar Chausa, the Ganga brings in about 350 cumecs flow, and then flows for about 445 km through Bihar. And we have committed 1724 cumecs in the Farakka Treaty, and this figure is monitored in real time. But the amount of water that comes in should also be monitored throughout the year, only then we can calculate a figure.

> **RIVER CONSERVATION,** water navigation and flood management – are the most important issues for the geographical region of Bihar

Arth Ganga – River Conservation Synchronised Inland Water Navigation and Flood Management

Kees Bons, Deltares, NL

- More than a hundred million cubic meters of gravel, sand and mudflow per year come out of Nepal and enter to the Koshi river system in India. The causes of the 2008 flood in Bihar was that the incoming sediments were confined between embankments, and the river bed was raised considerably.
- The Yellow River in China has the second highest sediment load in the world after the Ganga Brahmaputra system, and it has the same problem of devastating floods. But instead of embanking it, there are a number of very cleverly placed guidance structures that nudge the river in the right direction at the right place without confining it. That causes the river, especially the dry season flow of the river, to stay in more or less the same place. So there is less loss of land, less need for dredging, and less costly dikes, while nature does the job of flood containment.
- The concept of "room for the river" does not mean that we retract and just leave the space for the river to use as it wishes; it means that we manage the space in such a way that the river can use it when the river needs it and we use it when we need it. So we remove a lot of the original embankments, obstructions, groynes, etc. that were trying to control the river.
- Sediments are crucial for river dynamics and stability. You have to give ample room to the river because she will take it anyway if you don't. We have to adjust land use and building types in the zone that we share with the river and design an adaptive approach that can adapt to changes, and then we monitor key parameters that indicate the essential changes.
- Most ships in Europe have their own sensors on depth, but generally these sensors give information only to the pilot of the ship. Now we have developed a system that information is transferred by a mobile network data network to servers, and this data is analyzed and shared. That makes possible real time monitoring of the shifts in the sediment in the river from day to day.
- Inland water transport can be safe, economical and sustainable, but it requires that all aspects of the water infrastructure, the ferries, the ports and bridges are managed in the coordinated manner with timulating governance.

IN JUNE 2017,
wildlife clearance for movement of vessels to the sea through the Turtle Wildlife Sanctuary was taken from the National Board for Wildlife

SK Gangwar, Member (Technical), IWAI

- It is to be seen that how the agricultural sector, which consumes 80-90 percent of mean season flow for irrigation, can save some water which could then be reverted to the river so that the rivers would have flow depth of at least of 2-3 m in the driest season.
- In the lean season, there are often several parallel channels flowing in the Ganga river in many stretches. We survey each and every channel, take soundings and whichever channel is deeper and has more discharge, we notify that channel for navigation.
- We also increase the flow and depth in the preferred channel by bundling, an eco-friendly method by using bamboos, technically termed surface panel, to divert water from the smaller streams into the stronger stream so that there is some natural augmentation of discharge. In River Ganga we find 1.5 m or more depth in the driest season in most places, but by bundling we can effectively increase the depth by 1 meter more.
- We have been taking all necessary measures for protection of dolphins. Moreover, dolphins stay in the deeper channel basically, where dredging is not required for navigation.
- We have covered ecological aspects in all our planning. In June 2017, wildlife clearance for movement of vessels to the sea through the Turtle Wildlife Sanctuary was taken from the National Board for Wildlife. We also addressed the issue of the navigation lock at Farakka. We have also commissioned a consultancy for the Ganga Dolphin in December 2017 to assess, identify and prepare a plan for navigational activity on Gangetic Dolphin or any other aquatic animal.

Arth Ganga – River Conservation Synchronised Inland Water Navigation and Flood Management

Ruchi Badola, Scientist - G, WII

BETWEEN 1978 TO 2019,
25 percent decline of the Gangetic River Dolphin occurred in the main stem of Ganga and its tributaries

- Among different factors affecting the Ganga River biodiversity, the significant ones are reduced flows due to water abstraction for agricultural purposes, obstruction by dams and barrages, changes in river morphology due to constructions, water pollution, habitat changes and loss, excessive fishing, and decline of wildlife species due to poaching, especially of turtles.
- In species-driven conservation planning for any ecosystem, including rivers, we look at 3 types of species – the umbrella species which are selected for making conservation decisions, the flagship species selected to act as ambassadors, icons or symbols for a defined habitat, and a keystone species whose absence makes drastic impact on the ecosystem structure. The Gangetic River Dolphin, which is also our national aquatic animal, covers all 3 categories – it is the flagship species, the umbrella species, and also the keystone species of the Gangetic river ecosystem.
- Between 1978 to 2019, 25% decline of the Gangetic River Dolphin occurred in the main stem of Ganga and its tributaries.
- The distribution of dolphins and our national waterways perfectly overlap because the key areas for dolphin distribution also start downstream of Kanpur Barrage, in fact from Prayagraj, where the Ganga joins the Yamuna, and there is adequate depth in the river to support dolphins and where the dolphins are mostly confined.
- The NMCG- WII project on Arth Ganga includes biodiversity conservation, sustainable development and livelihood programs, the Ganga Dolphin Jal Safari (which is leading towards sustainable Ganga Tourism), river rejuvenation and restoration involving state forest departments and local communities (which is being extended to the Ganga tributaries), and conservation education through construction of interpretation centres, Ganga Museum or Ganga Avlokan.
- The response of dolphins to navigation and dredging, particularly on their acoustic and metabolic activities due to navigation can be significant. As a parallel, one-third of the decline of the Yangtze River dolphin of China was due to ship strikes, the dolphins becoming natural road-kill because, due to the echolocation impacts of the ships' sonars, they became effectively blind.
- The impact of national waterways will definitely be there, including on the tributaries which are extremely important for the river ecosystem and the conservation of species. Onboard sonars, which interfere with dolphin navigation, and the need of least available depths of 2 to 3 m, require some kind of dredging, will render changes in the river ecosystem. We need to regulate spatiotemporal movement of vessels, propeller guards, vessel noise muffling devices, etc., and a lot of other solutions might be available from the global experience.

Valedictory Session

Rajiv Ranjan Mishra, DG, NMCG

DAY 6:
Tuesday, December 15, 2020
18:00 – 19:00 hrs

MODE:
Virtual

CHAIR:
Vinod Tare [Founding Head, cGanga, IIT Kanpur]
Rajiv Ranjan Mishra [DG, NMCG]
Rozy Agarwal [ED (Finance), NMCG]

CHIEF GUEST:
Gajendra Singh Shekhawat [Hon'ble Minister, Jal Shakti Ministry, GoI]

GUEST OF HONOUR:
Hardeep Singh Puri [Hon'ble Minister of Housing and Urban Affairs, GoI]

INVITED SPEAKERS:
UP Singh [Secretary, Jal Shakti]

KEYNOTE ADDRESS:
Rajiv Kumar [Vice-Chairman, Niti Aayog]

VOTE OF THANKS:
Rozy Agarwal [ED Finance, NMCG]

- This year's five-day Summit primarily explored the question of synchronizing river rejuvenation, river conservation and ecologic rejuvenation with the development process, wherein we looked at different development sectors like agriculture and allied activities, tourism, culture, energy, flood management and other issues.
- More than three thousand experts participated in different sessions and more than two lakh people have viewed it through different channels. It has been a great success.

Vinod Tare, Founding Head - cGanga

- The approach that we have followed in this particular IWIS of dealing with the river, that is comprehensive analysis and holistic management of local rivers and water bodies, has been endorsed unanimously by one and all, and I think this is going to become a world model. This approach would be very effective for restoring and conserving big rivers.
- Nothing can be a more important tool than looking at conservation and development together in the form of the wonderful gift that has been given to us by our Honourable Prime Minister in the first Ganga Council Meeting, that is through the lens of Arth Ganga. Arth Ganga is a very powerful tool to explain such a complex phenomenon to the people at large in a simple manner, and this will make it a Jan Andolan.
- The concept of Arth Ganga will be understandable to everybody, and we are seeing that – not only in India – it is also being applauded worldwide now.
- We are preparing a draft *communiqué* of all that has happened in this particular Summit, and I will release it in time to come.

Valedictory Session

UP Singh, Secretary, Jal Shakti Ministry

- Earlier I felt that “water use efficiency” or “over-extraction of surface water or groundwater” has little to do with Ganga rejuvenation or Ganga cleaning. But today we know that checking water over-exploitation is essential. The paradigm shift in our Namami Gange program also covers not just constructing sewage infrastructure, but their performance.
- A lot of things have emerged from the discussion in this IWIS. Now there is a huge task for NMCG as well as cGanga to connect the dots and carry them forward for effective implementation.

Rajiv Kumar, Vice-Chairman, Niti Aayog

- I congratulate NMCG for hosting the 5th India Water Impact Summit which is amazing. On reviewing the previous four Summits I was impressed by their outcomes and recommendations. The twenty technical sessions served an amazingly rich fair at this summit.
- This summit is perhaps the only one of its kind in the world with such a wide diversity of expertise gathered here focusing on just one topic, which is the holistic development of the river basins and the water bodies.
- Ganga is sacred to us, but it also has six hundred million people living in its basin with forty percent of the country's GDP emerging from this area, one-third of the service water of the country being provided by the Ganga basin and nearly twenty one thousand megawatts of hydro potential. Thus Ganga and its tributaries are one of the basic pillars of India's economy and India's civilization. However, there is a lurking danger that for some years now there have been unprecedented low levels of water in the downstream Ganga. This is quite serious because in time to come it appears that the access to groundwater for the Ganga and its tributaries will decline as we draw more and more water from the ground for our for irrigation purposes. Hence NITI AAYOG have been pushing for the practice of chemical-free natural farming – propagated by Subhas Palekar-ji and many others – which reduces the use of water to almost a fourth of the water.
- I came to know recently from Professor Walter Yanni, an agro-economist from Australia, that moisture in the air has seven times the water that we have on the surface and under the ground, and if this moisture could be fixed in croplands as rainforests do by improving the quality of the soil, by improving the humus content in the soil, by improving the organic carbon content in the soil, then our water use can be reduced to a fourth of what it is today.
- We have to adopt the model of a sensitive agro-economy with better use of water, and NITI AYOG, along with the Ministry of Rural Development, are pushing that forward as a program for rural rejuvenation of water bodies under the MNREGA program.
- The Japanese have a saying that if you want to clean the stream below, then you have to start with cleaning the stream up in the mountain so that the dirt doesn't get there. In the case of Yamuna, for example, 60% of the pollutants come from a 22 km stretch around Delhi, and we need to handle that. I had proposed the formation of a Yamuna Development Authority so that all the 23 agencies which look after the Yamuna today would be brought together under one organization to take care of the Yamuna, which will take care of the Ganga itself.
- Our rivers will not be saved if it is only the responsibility of the government – whether the central or state or local governments. Our rivers will be saved only when the communities around them recognize the need. We have to create a Jan Andoloan as the Honorable Prime Minister continues to tell us. I really appreciate the work that has been done for the NAMAMI GANGE program by creating documentaries, publishing books, and creating awareness all around the Ganga to convert it from just Ganga to Arth Ganga mission by creating economic opportunities on the shores of the Ganga and its tributaries, so that people see rivers as giving them life and employment opportunities.

Valedictory Session

NMCG AND NIUA HAVE

developed a first of its kind strategic framework for managing urban river areas in the Ganga River Basin called the Urban River Management Plan, is a river-centric planning framework designed to help cities manage river stretches within their jurisdictions

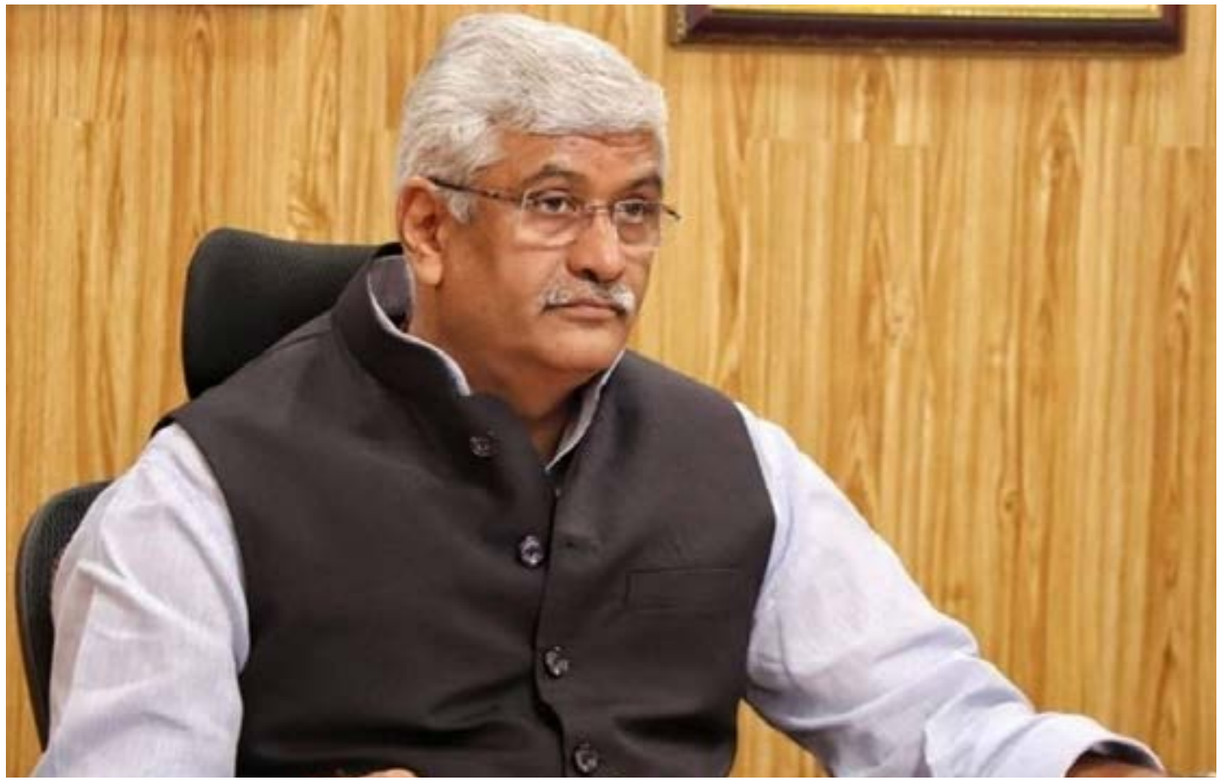
Hardeep Singh Puri, Hon'ble Minister, Housing and Urban Affairs, GoI

- By 2030 when the United Nations completes its work on the 2030 agenda of sustainable goals about six hundred million Indians will be living in urban areas representing 40% of our population. Hence India has to build around 700 to 900 million square meters of urban space every year until 2030. We have 53 metropolitan cities with million-plus populations of which 42 cities are river-centric. This signifies the interactions between rivers and the dependent urban centres. This dependency is complex, reciprocal and collaborative, and needs to be transformed into sustainable symbiotic relationships with availability of clean water becoming of increasing concern. India has no shortage of either coast line or rivers; what we require is a comprehensive strategy to recycle, reuse and treat water. We are acutely conscious of this imperative as more than 70% of service water sources are reported to be polluted and municipal sewage is a primary source of pollution.
- Under the flagship Atal mission for rejuvenation and urban transformation, the Swachh Bharat Mission and the Smart Cities Mission, the Ministry of Housing and Urban Affairs have contributed to keeping the waterbodies clean – including River Ganga. Some key activities undertaken are decentralized network, underground sewage systems including augmentation of existing sewage systems and sewage treatment plants, rehabilitation of old sewage systems and treatment plants, recycling of water for beneficial purposes and reuse of wastewater, faecal sludge management, clean transportation, cost-effective treatment of faecal sludge, rejuvenation of waterbodies for drinking water supply, groundwater recharge, riverfront development, cleaning of waterbodies, boating and water sports facilities, improvement of lakes, construction and compaction along certain river canals, and drain improvements.

- In a sense the Swachh Bharat Mission represents the fulcrum of all flagship programs of the Prime Minister. On the urban part, we have met its physical targets and what is remarkable is that, apart from the physical targets being met both in terms of individual household connections and community and public toilets, it also generated a Jan Andolan and became a government project of the people with active participation of all 4340 urban local bodies in India.
- The Ganga River Basin is host to 97 urban centres and 4457 villages just on the main stem of the Ganga, besides several more in sub-basins located on banks of tributaries such as Yamuna, Ram Ganga, Kali, Gomti, Ghagra, Gandak, Damodar, etc. Through the various programs, we continue to support the towns through which the Ganga flows with 97 cities across 5 states being assisted in achieving ODF status. Solid and liquid waste management projects under Swachh Bharat Mission and Amrut are also underway in these cities. The Swachh Bharat Mission (SBM) urban program has twin objectives of making India Open-Defecation Free and ensuring 100% scientific disposal of municipal wastes. Under SBM, we have taken some concrete steps for addressing cleanliness issues of Ganga towns and waterbodies.
- NMCG and NIUA have developed a first of its kind strategic framework for managing urban river areas in the Ganga River Basin called the Urban River Management Plan. This framework is a river-centric planning framework designed to help cities manage river stretches within their jurisdictions.
- This five-day conference has aided in creating a platform for significant interactions between different stakeholders in the water sector and also to promote international cooperation between India and many countries for water and river management. This conference has opened important avenues for developing integrated policies, innovative financial and business models for investment in urban and local water infrastructure; this will help us move towards sustainable management of our water resources as well as human settlements.

Valedictory Session

Gajendra Singh Shekhawat, Hon'ble Minister, Jal Shakti Ministry



- गंगा नदी घाटी प्रबंधन एवं अध्ययन केंद्र (cGanga) जब राष्ट्रीय स्वच्छ गंगा मिशन के एक ज्ञान–सहायक के रूप में, इस गंगा नदी के कायाकल्प के लिए, इसकी अविरलता और निर्मलता के लिए और उस संकल्प में अपनी भूमिका के निर्वहन के लिए, जिसका गठन किया गया था, उसमें उसने उस संकल्पना से कहीं आगे बढ़कर जल के क्षेत्र में देश को जल समृद्ध बनाने और साथ में जल से जुड़े हुए विभिन्न पहलुओं पर जिस तरह से लगातार विभिन्न अध्ययनों के माध्यम से, और पांचवें संस्करण में इस शिखर सम्मेलन से जिस तरह से योगदान दिया है, मैं उसके लिए एक बार फिर cGanga की टीम को धन्यवाद देना चाहता हूं, उनका आभार व्यक्त करना चाहता हूं।
- भारत में आबादी और उपलब्ध जल के अनुपात में प्रकृति ने हमारे साथ में अन्याय किया है लेकिन फिर भी अनेक बार अनेक अवसरों पर हम सब ने चर्चा की है कि हम जल की कमी वाले देश नहीं है। आज भी जितना जल प्रकृति ने हम सब को दिया हमको ठीक से प्रबंधन करने की आवश्यकता है, और यदि हम उस में सफल होते हैं तो निश्चित रूप से हम आने वाले अनेक वर्षों तक अपने देश को जल समृद्ध या जल के दृष्टिकोण से समृद्ध बनाए रखने में कामयाब हो सकते हैं।
- यदि कोई एक चीज सबसे आवश्यक है, वह जल है क्योंकि उसके बिना सारे विकास के कार्य बेमानी हो जाते हैं, उनका अस्तित्व ही संकट में आकर खड़ा हो जाता है। इसलिए सतत विकास के लक्ष्यों में जल की उपलब्धता को सुनिश्चित करना, उपलब्धता को बनाए रखना पूरे विश्व के विकास के परिदृश्य में सबसे महत्वपूर्ण घटक है।
- हमारे जल संसाधनों की पहचान करना, उनके आंकड़ों को एक ज्ञान कोष में, एक जगह इकट्ठा करना, अपने जल संसाधनों का प्रबंधन उचित रूप से करना, भारत को जल समृद्ध बनाने के लिए आवश्यक है।
- "बहुत ज्यादा पानी, बहुत कम पानी, तथा प्रदूषित पानी" इन तीनों के कारण से हमारे जितने बड़े देश में विविध चुनौतियां भरी हैं। निश्चित रूप से उसका समाधान यदि कहीं है तो वह हमारे भू–गर्भ के जल में वापस पुनर्भरण करके उनको सतत बनाए रखने के माध्यम से ही हो सकता है, मुझे अत्यंत प्रसन्नता है कि माननीय प्रधानमंत्री जी के नेतृत्व में हमने अपने भूगर्भीय जल कोष की पहचान करने के लिए काम करना प्रारंभ किया है। हेलीबोर्न भूभौतिकीय सर्वेक्षण के माध्यम से भूगर्भीय जल कोष को पुनर्भरण करने का काम भी प्रारंभ किया है।
- मुझे अत्यंत प्रसन्नता है, पिछले वर्ष आज से लगभग 1 साल पहले 25 दिसंबर को गुड गवर्नेंस डे के दिन पूर्व प्रधानमंत्री स्वर्गीय अटल बिहारी बाजपेई जी के जन्मदिवस के अवसर पर माननीय प्रधानमंत्री जी के कर कमलों से हम लोगों ने एक पायलट प्रोजेक्ट अटल भू–जल योजना के नाम से भी प्रारंभ किया।
- वर्ल्ड बैंक के सहयोग से 6000 करोड़ रुपए की इस परियोजना के ऊपर काम कर रहे हैं, ताकि हम भू–गर्भ के जल के पुनर्भरण की दिशा में देश में लोगों की भागीदारी, सामाजिक सहभागिता के आधार पर हम उस दृष्टिकोण से काम करते हुए अपने भू–गर्भ के जल को सतत बनाए रखने के लिए काम करते रहे।
- आज से पहले हमने पानी की तरफ जब भी देखा तो हमने उसको एक साधन के रूप में देखा. लेकिन अब समय आ गया है कि अब हमको अपनी मांग पक्ष को भी प्रबंधित करना पड़ेगा। जिस अटल भू–जल योजना के बारे में मैंने आपके सामने चर्चा की वह निश्चित रूप से इस दिशा में एक ऐतिहासिक कदम गिना जाएगा।
- कोविड–19 आपदा के कारण से परिस्थितियां थोड़ी अलग थी, अधिकारियों का जाना संभव नहीं था, शारीरिक गतिविधियां प्रतिबंधित थी, लेकिन फिर भी मैं बधाई देना चाहता हूं मंत्रालय के अधिकारियों को, उन्होंने इस बार इस आपदा के होते हुए भी तमाम कठिन परिस्थितियों के होते हुए भी, अपने इस कार्यक्रम को एक बार रुकने नहीं दिया, इसे और आगे बढ़ाया। कैच द रेन कैंपेन के साथ में हमने काम किया, और हमने पूरे देश भर में जहां पिछली बार पायलट के रूप में प्रारंभ किया था, कुल मिलाकर के 250 जिलों के आसपास में काम किया था, अबकी बार पूरे देश में 700 जिलों में एक साथ इस चेतना की जागरण के लिए काम किया।

कैच द रेन कैंपेन के साथ में हमने काम किया, और हमने पूरे देश भर में जहां पिछली बार पायलट के रूप में प्रारंभ किया था, कुल मिलाकर के 250 जिलों के आसपास में काम किया था, अबकी बार पूरे देश में 700 जिलों में एक साथ इस चेतना की जागरण के लिए काम किया

Valedictory Session

"बहुत ज्यादा पानी, बहुत कम पानी, तथा प्रदूषित पानी" इन तीनों के कारण से हमारे जितने बड़े देश में विविध चुनौतियां भरी हैं

- अभी आदरणीय हरदीप पुरी जी आमूलचूल परिवर्तन की बात कर रहे थे, उन्होंने कहा कि अब हमें नदी केंद्रित दृष्टिकोण के साथ में सोचना पड़ेगा, नदी की क्या आवश्यकता है उस दृष्टि से शहरों में विकास और उसके विकास की योजना को बढ़ाने की दिशा में काम करना पड़ेगा। माननीय प्रधानमंत्री जी ने कहा कि गंगा हमारे लिए आस्था का विषय है, गंगा हमारे लिए विश्वास का विषय है, गंगा हमारे लिए मोक्षदायिनी है, इस दृष्टिकोण से सोचने का विषय है, लेकिन साथ ही साथ में हमें इस बात को भी नहीं भूलना चाहिए कि गंगा देश की लगभग 40% – 42% आबादी की जीवनदायिनी भी है, और हमें किस तरह से गंगा के नेतृत्व में विकास, और उसके आर्थिक पक्ष को साथ में जोड़कर काम करना है, उस पर विचार करना है।
- माननीय प्रधानमंत्री जी के नेतृत्व में हमने गंगा आधारित सतत विकास जिससे नदी को भी नुकसान ना हो और आर्थिक संपन्नता के साथ में नदी के साथ में चेतना और नदी के साथ में जुड़ाव हो इस दृष्टिकोण से भी काम करना हम सब ने प्रारंभ किया है।
- हम सब ने अपने बचपन में जिन नदियों को देखा होगा, उनको खोते हुए भी देखा है, वह नदियां वापस पुनर्जीवित हों, हमारी छोटी–छोटी नदिया वापस बने, हमारे वेटलैंड्स वापस संरक्षित हों, हमारे जो पारंपरिक जल निकाय हो, वापस ठीक कर पाएँ और हम अंतिम लक्ष्य यह रखें कि हम अपने देश को एक बार फिर जल समृद्ध बना पाएं।
- आज इस समापन समारोह में, मैं कह सकता हूं, इस सम्मेलन में जिस तरह की चर्चाएं जल के पहलू को लेकर के हुई हैं, जिस तरह की बातचीत इस समिट में हुई है, जैसे मैं अभी प्रोफेसर तारे ने जो नयी रिपोर्ट बनाई है, उसको मैं थोड़ा सा देख रहा था, जल के प्रति सम्मान का भाव, लोगों में किस तरह से चेतना का जागरण करें, इसके लिए भी हम सबको विचार करने की, काम करने की आवश्यकता हैद्य
- इस 5 दिवसीय शिखर सम्मेलन में हमने जो बातचीत की है, इस समय में हमने जो अपनी चिंताएं व्यक्त की हैं, हमने जो मार्ग अपने अनुभव के आधार पर सुझाए हैं, हम इन विषयों को केवल यहां तक समाप्त ना करें, अपितु हम इन विषयों को किस तरह से आगे ले जा सकते हैं, नीति निर्माता चाहे वह राज्यों में काम करने वाले हैं, चाहे भारत सरकार में काम करने वाले हैं, चाहे शिक्षा संस्थान में काम कर रहे हैं, हम सबके जहन में यह विषय किस तरह से ताजा रह सकता हैं? मैं चाहूंगा इस तरह की ज्ञान कोष बनाएं जिसमें यहां जितनी चर्चाएं हुई है, इसके अतिरिक्त भी जितने तरह की अध्यन हम साल भर में करते हैं, और पिछले वर्षों में हमने की हैं वह एक जगह पर सारी संकलित करके रखी जा सके ताकि ऐसे सारे महत्वपूर्ण विषयों पर अनुसंधान को नीतिगत योजना करने वालों को आसानी से उपलब्ध हो और वह उस अनुभव का लाभ ले सके, इस दृष्टिकोण से भी हमें काम करना पड़ेगा।
- जल समस्या एक साझी समस्या है, सब की सामूहिक समस्या है, पूरे विश्व की सामूहिक समस्या है और इस पर एकाकी चिंतन से कभी सफलता प्राप्त नहीं हो सकेगी। दुनिया के कुछ देश हो सकते हैं, जो शायद यह सोचे कि विकास करना हमारा अधिकार था, उसके गहरे प्रभाव हुए हैं, उन सब से अपने आपको अलग करके सोचना, मुझे लगता है कि ऐसे एकाकी प्रयास, एकाकी सोच अंततः पूरे विश्व के लिए नुकसानदायक होगी, हम सब को सामूहिक रूप से सोचना पड़ेगा, सामूहिक रूप से विचार करना पड़ेगा, सामूहिक रूप से चिंतन करना पड़ेगा और सामूहिक रूप से समाधान के लिए एक दूसरे का हाथ पकड़ कर के प्रयास करना पड़ेगा, ऐसी आवश्यकता है। इस तरह के शिखर सम्मेलन, इसमें पूरी दुनिया के लोग साथ जुड़े हैं, निश्चित रूप से एक मार्ग को प्रशस्त करते हैं, मार्ग को रोशन करते हैं। इसके आयोजन के लिए मैं एक बार फिर सबका धन्यवाद देना चाहता हूं, जिन लोगों ने अपने अनुभव को साझा किया। उन सब मुख्यमंत्रियों का, जिन्होंने समय निकाल कर के सम्मेलन को सफल बनाने के लिए अपने अनुभव को साझा किया, उन सब का भी मैं एक बार फिर बहुत अभिनंदन करना चाहता हूं।

जय हिंद।

Valedictory Session

- Being the head of this family, I would like to thank all the participants from India and abroad, other ministers of the Government of India, ministers of different states, Chief Ministers of many states, and subject experts whose Guidance, whose experience also benefited this five-day summit, which was in the form of a “Vaicharik Mahakumbh”. Friends, before I say anything, I would like to congratulate the Namami Gange Mission and especially the Center for Ganga River Basin Management and Studies, which we commonly call as cGanga, Dr Tare and his entire team as they have done well in the face of all adversity. Despite all adversity, this summit was not only successfully organized, but a new record has been set for the success of the summit.
- cGanga has commendably organized this 5-day summit, where various discussions on Nirmal and Aviral flow of Ganga, and issues of water sector took place. By contributing to complete transformation of water sector and emphasizing the fact that Ganga is synonym to rivers in the Indian ethos, cGanga, a knowledge partner of the National Mission for Clean Ganga that was formed to fulfill its role in the resolution of Swachtta and Nirmalta of Ganga, went far beyond its mandate. I would like to thank the team of cGanga once again for the kind contribution they have made.
- Nature has done injustice to us in the ratio of population and available water in India, but still we have discussed many times on many occasions that we are not a water-scarce country. Even today, as much water as nature has given to all of us, we need to manage it properly, and if we are successful in that then surely, we can successfully keep our country water rich for many years to come.
- If we consider any one most essential thing, it is certainly water because without it all development works become of no use, their very existence comes under threat. Therefore, ensuring the availability of water in the Sustainable Development Goals, maintaining the availability of it is the most important component in the development scenario of the whole world.
- It is utmost important to identify our water resources, collect all relevant data in one place in a repository to make India prosperous in water sector and manage our water resources sustainably.

> **TOO LITTLE WATER,**
> **too much water and too polluted water, because of these three, a country as big as ours is full of diversified challenges**

- Too little water, too much water and too polluted water, because of these three, a country as big as ours is full of diversified challenges. Surely there is a solution if any, it can only be through making water resources sustainable by recharging back into our ground water, and I am very happy that under the leadership of Hon'ble Prime Minister we have initiated to identify our aquifers. Be it heliborne survey, or Geo-Special Studies, we are taking all possible help of technology and started working together to recharge the aquifers.
- In this bid, about 1 year ago today, on the occasion of the birthday of former Prime Minister Late Atal Bihari Bajpai ji (on 25th December-the Good Governance Day), we started a pilot project and scheme ‘Atal Bhujal Yojna’ inaugurated by Hon'ble Prime Minister.
- We are extracting a lot of groundwater for our needs, the Groundwater needs to be used sustainably. We are working on Atal Bhujal scheme with support of about 60 billion INR from World Bank. So that we work in the direction of replenishment of groundwater in the country with the help of people and community participation.
- Previously, whenever we looked towards water, we saw it as a resource and supply augmentation challange. But now the time has come, we have started to talk about managing our demand-side also. The Atal Bhujal Yojana, which I mentioned earlier, will certainly be counted as a historic step in this direction.
- Due to the Covid-19 epidemic, the circumstances were a little different, it was

Valedictory Session

not possible for the officials to go in fields so frequently, physical movement was restricted, they were facing all the difficult situations. Despite this, they did not let the program stop once. I want to congratulate the officials of the ministry for their efforts and hard work. Catch the rain where it falls, we worked with this slogan in around 250 districts across the country as pilot last time. This time we worked together in 700 districts of the country for the awakening of this consciousness.

- Respected Hardeep Puri ji was talking about paradigm shift, he said that now we have to work with river centric approach, we will have to think of development and development plans in the cities based on the demand and need of rivers, locally. As Hon'ble Prime Minister mentioned, Ganga is not only matter of faith and salvation for us, but life of about 40-42% of the population of the country is dependent on Ganga and its system. We need to think how conservation of Ganga and regional economic development can go hands-in hand.
- Under the leadership of Hon'ble Prime Minister, we have started working on Ganga centric sustainable development so that the river is not harmed and along with economic prosperity, there should be consciousness and connectivity with the river.
- Most of us must have seen losing our rivers we saw in our childhood. These rivers should be revived, our small rivulets should get back, our wetlands should be conserved, our traditional water bodies should be restored. While working in this direction we should keep the goal to make our country water rich once again.
- Today in this valedictory ceremony, I can say, we need to consider and work on the kind of discussions that have taken place in this summit regarding various aspects of water and rivers. As I was going through one of the reports made by Prof Tare and cGanga team, we need to have respect for water. We should also work on how to awaken consciousness in people.
- In this 5-day summit, we have expressed our concerns, suggested solutions to the concerns based on our experience. Let's not stop here and take these subjects forward, lets keep this discussion alive amongst policy and planners at various levels, whether they are working in the state or central government or scientific and academic institutions. I would like to make such a repository that contains all the discussions that have happened here, in addition to all the studies we do throughout the year, and we have done in the past years, that can be compiled in one place so that all such important topics and research should be readily available to policy-planners, and they can take advantage of this experience.
- Water problem is a collective challange, a collective problem of all, a collective problem of the whole world and success will never be achieved by thinking alone on it. There may be some countries in the world, which may think that it was our right to develop, then if it has had a deep impact, would like to think differently from all of them, I think such lonely efforts, lonely thinking will ultimately be harmful for the whole world, we all have to think collectively, and try to collectively hold each other's hand for solution. With this kind of impact, people from all over the world coming together, certainly leading a path, illuminating the way. I would like to thank once again everyone for organizing this event, all those who shared their experience. I would also like to congratulate once again all those Chief Ministers, who took out their time and shared their experience to make the summit a success.

Rozy Agarwal, ED Finance, NMCG

- The Hon'ble Jal Shakti Minister present here with us for the concluding session has provided us with a very powerful and enlightening talk on river conservation linked with all-round development along the river. Sir, we are grateful to you for your continued guidance and support in river rejuvenation efforts, for showing us the right way ahead, and for talking about creating a repository of studies which can be a reference point for researchers.
- The end of this Summit may not be the end of the agenda, in fact it is the beginning, a new beginning in which we all have to work together closely in a collaborative manner to implement the ideas which came up during the summit and make a visible impact on the ground.

SESSION A

THEMATIC SESSIONS' PROCEEDINGS

DAY 1:
Thursday, December 10, 2020
09:15 –10:45 hrs

MODE:
Virtual

CHAIR:
Vinod Tare [Founding Head, cGanga, IIT Kanpur]

PANELISTS:
Sejal Worah [Programme Director, WWF India, New Delhi]
Mallika Bhanot [Ganga Ahvaan]
JV Tyagi [Director, National Institute of Hydrology, Roorkee]
Shyam R Asolekar [Professor, Indian Institute of Technology Bombay]
Ravi Agrawal [Additional Secretary, SACON, NMNH Cell, WRC Division MoEF&CC, New Delhi]
Kees Bons [Strategic Advisor, Deltares, NL]
Anshumali [Professor, Center for Water Resource Management, Dept. of Environmental Science and Engineering, IIT (ISM), Dhanbad]
R Bhattarai [cGanga, IIT Kanpur]

PANELISTS


Anshumali


Kees Bons


Ravi Agrawal


Shyam R Asolekar


Sejal Worah


Mallika Bhanot


JV Tyagi


Ajith Radhakrishnan


Bharat Jhunjhunwala


Arun Kumar


Paritosh Tyagi


Ashish Pandey


SP Singh


S K Ratho


Ritesh Vijay


Victor Rana Shinde


Manu Bhatnagar


Suresh Kumar Singh


Anshuman


M Dhinadhayalan


Suresh K Rohilla


PS Rana


R Bhattarai


Suresh Babu SV


Ajay Pradhan


RK Sinha


CKL Das


BK Das

A1: Arth Ganga – River Conservation Synchronized Development

A PROPER ECONOMIC

valuation of rivers or river stretches will provide good information to enable holistic development and to convince all stakeholders that economic growth will be better if the river stretch is kept healthy

A1.1. PROBING THOUGHTS

Arth Ganga literally means the total value of River Ganga, but it is also the total value of any river since all rivers are like the Ganga. The total value of a river is the sum of the river's *tangible values* (comprising of the goods and services provided by the river ecosystem, such as water, sediment, nutrients, biodiversity, hydropower, navigation, etc.) and *intangible values* (which are the river's physically unquantifiable attributes such as its aesthetic, mystical, spiritual, and other timeless qualities). Since only the tangible values can be quantified in terms of human use or economics, hence the focus of Arth Ganga in IWIS-2020 was on the tangible values of rivers and waterbodies of the Ganga River Basin and other river basins of India. Generally, the tangible values are also a reflection of the intangible values since both the tangible values and intangible values are high for a healthy river, whereas both values reduce significantly when a river deteriorates. Thus the tangible and intangible river values are related.

Anthropogenic activities in the Ganga Basin and other River Basins of India have been changing since industrialization began, and the changes have accelerated and multiplied with India's developmental push. These changes have often had significant, adverse consequences on rivers and waterbodies, which vary in different parts of the basin depending on their bio-physical environment and the activities carried out. Such adverse consequences on rivers have, however, slowed down the developmental momentum. The need to conserve our rivers and waterbodies is, therefore, essential to sustain the developmental surge as well as to maintain healthy river functioning for their benefits to humans, that is, to maximize the net value of development over the long term. Noticeably, many small rivers and waterbodies of the Ganga basin have degraded in recent decades due to intense developmental activities in their catchments. These small rivers and waterbodies, in turn, have affected larger rivers into which they flow, setting off a cascading effect for the entire river system. Hence, the river conservation objective of Arth Ganga may be best achieved by a bottom-up approach of prioritising the revival and conservation of small rivers and waterbodies instead of a top-down method of trying to conserve only the main-stem river. Integration of development with river conservation

A1: Arth Ganga – River Conservation Synchronized Development

therefore should be carried out simultaneously at various geographical-administrative levels.

A1.2. KEY QUESTIONS

In the above context some critical issues that need to be addressed and resolved are:

- What are the *important development sectors* in Ganga basin that are closely linked to river conservation and river values?
- In which *states or parts of the Ganga basin* are these developmental sectors important?
- What are the *alternative developmental options* for these sectors?
- What are the *linkages* of different developmental options with river conservation?
- What are the *bottlenecks in adopting* alternative developmental options?
- Is there any ready *assessment of the economic value* of goods and services provided by rivers and waterbodies in the Ganga basin? If not, then how can they be evaluated?
- How can the *intangible river values* be assessed? Can such assessment be carried out by *reputed artists (e.g. painters, poets, creative writers, performing artists, film-makers, etc.), spiritual leaders, community elders, and select other people of heightened sensibilities*?
- Can the *net value of development-plus-rivers* be increased over the long term by selecting specific development options?
- Can there be any active role of *local communities, ordinary citizens, and small stakeholders* in integrating development with river conservation? How can they be empowered for this?
- What *monitoring and evaluation mechanism* should be adopted to evolve synchronization of development with river conservation?
- What *policies and programmes* should be adopted to integrate development with river conservation at national, state and local levels?

A1.3. DISCUSSIONS

The need for river conservation is typically emphasized by civil society organizations and faith leaders, often without considering developmental needs. On the other hand, industry and business sectors champion developmental thrusts without considering river conservation. It is necessary to resolve this dichotomy so that all sections of society agree to a common path. It is also clear that development does not necessarily degrade rivers, it is the specific developmental choices made that determine their impacts on rivers and waterbodies. If river conservation and economic development have to go hand in hand then we need to adopt basin wide management and planning by first assessing the requirements of the basin in terms of water, energy and other resource needs and the ecosystem services available in order to plan the developmental activities while safeguarding the basin's geology. The goods and services provided by rivers are multifarious and many, and may be directly or indirectly linked to rivers such as forestry, renewable energy, agriculture, horticulture, biodiversity, wetlands, tourism, and handicrafts. Some of these goods and services may have only niche markets, but if such markets are adequately developed then tremendous value addition can ensue from river conservation, with the Ganga river itself being a brand for the products. A proper economic valuation of rivers or river stretches will provide good information to enable holistic development and to convince all stakeholders that economic growth will be better if the river stretch is kept healthy. Different rivers, river stretches and waterbodies will need different strategies to help sustain livelihoods and economic growth. Finally, it may be noted that, rather than endless policing and penalties, incentives – like tax incentives – are needed to nurture people's habits and practices that affect rivers. This is also important because there is an increasing disconnect between people and rivers, so unless they are reconnected, it will be difficult to popularize river conservation.

DIFFERENT RIVERS,
river stretches and waterbodies will need different strategies to help sustain livelihoods and economic rowth

A1.4. RECOMMENDATIONS

The following major recommendations emerged from the discussions presented above:

1. **Civil society organizations and faith leaders often champion river conservation from a traditional or long-term perspective, while industry and business sectors champion development in the short or medium term. Opposing camps need to be brought together to chalk out a common path under the unifying concept of Arth Ganga.**
2. **Development does not necessarily degrade rivers, it is the specific developmental choices made that determine their impacts on rivers and waterbodies.**
3. **Developmental planning should be based on basin-wide river management and geological safeguarding by assessing water, energy and other resource needs and the ecosystem services available in the basin.**
4. **Goods and services that are directly or indirectly linked to rivers include forestry, renewable energy, agriculture, horticulture, biodiversity, wetlands, tourism, and handicrafts. Many of them have niche markets but can be of tremendous value – with the Ganga river itself being a brand for such products and services.**
5. **Proper economic valuation of rivers and river stretches are needed to enable holistic development and to convince all stakeholders that economic growth will be better if the river is kept healthy.**
6. **Policing and penalties are cumbersome and of limited value. Incentives – like tax incentives – are needed to nurture people's attitudes and habits towards river conservation and to connect them to rivers.**

A2: Arth Ganga – River Conservation Synchronized Human Settlement

DAY 2:
Friday, December 11, 2020
10:00 –11:45 hrs

MODE:
Virtual

CHAIR:
Vinod Tare [Founding Head, cGanga, IIT Kanpur]

PANELISTS:
Ajith Radhakrishnan [India Country Coordinator, World Bank Group]
PS Rana [Chairman, Construction Industry Development Council]
Suresh Kumar Rohilla [Senior Director, Centre for Science and Environment]
M Dhinadhayalan [Adviser (PHEE), MoHUA]
R Bhattarai [cGanga, IIT Kanpur]
Anshuman [Associate Director, Water Resources, TERI]
Suresh Kumar Singh [Professor, Jai Narain Vyas University, Jodhpur]
Anshumali [Professor, IIT (ISM) Dhanbad]
Manu Bhatnagar [Principal Director, INTACH]
Victor Rana Shinde [Team Lead, Water and Environment, National Institute of Urban Affairs]
Ritesh Vijay [Senior Principal Scientist, Centre for Strategic Urban Management, NEERI, Nagpur]

A2.1. PROBING THOUGHTS

Developmental activities have often significantly impacted rivers and waterbodies. The effects vary in magnitude in different parts of the Ganga basin depending on local bio-physical attributes and the nature of activities carried out. Adverse impacts on rivers and waterbodies have, however, slowed the developmental momentum in turn, and threaten to slow it down further or even throttle it at times. The need to conserve our rivers and waterbodies is, therefore, essential – both to sustain the developmental surge and to maintain healthy river functioning for their continuing benefits to humans, that is, to maximize the net value of development over the long term. This approach resolves the apparent dichotomy between river conservation and human settlement in India by embedding the principle of Arth Ganga in urban and rural habitat development policies and programmes of Central, State and Local Governments.

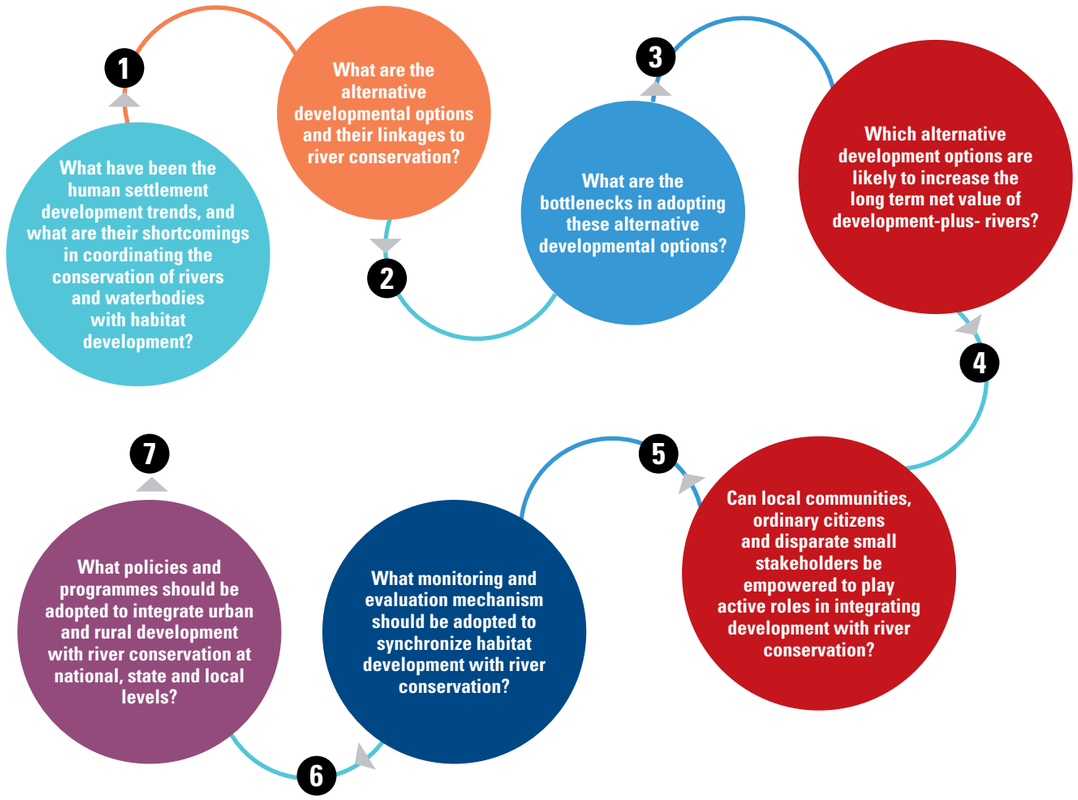
The growth of human settlements has been associated with major changes in the habitats including reduced or altered flora and fauna, clogging of waterbodies, blocked drainage routes, reduced groundwater recharge due to impervious built-up surfaces, increased water extractions, wastewater and solid waste disposal, and air, noise and light pollution. Rivers and waterbodies located within or near such habitats are hence affected by decreased dry season flows, increased water pollution, high stormwater runoff rates, loss of connection with waterbodies, floodplain encroachments, loss of riparian vegetation, etc. These problems, in turn, cause water scarcity, amplify floods, curtail land productivity and biodiversity, engender water-borne diseases, and reduce the recreational and cultural value of rivers. The Arth Ganga framework allows for harmonizing habitat development with river conservation. For this to happen the modalities of interconnecting River Conservation with Urban and Rural Development need to be decided.

A2.3. DISCUSSIONS

Arth Ganga means not only extraction from or utilising rivers but also their sustainability because, if rivers or water bodies are lost, there can be no navigation, tourism or other benefits to be obtained from rivers. We have to first correct our attitude – instead of treating a river merely as a water resource, we need to treat it as a living entity. The conflict of conservation versus development exists because the mainstream actors of development are select people who have a hardware-oriented approach, while conservation-oriented mainstream people are never considered seriously. We view energy, agriculture, transportation, etc. as development sectors, but not water supply, sanitation, waste management, urban drainage, or river conservation. These should also be considered as important economic sectors.

A2.2. KEY QUESTIONS

Some key issues of importance that need to be deliberated are:



There is a need to develop a methodology to segregate the contribution of river conservation from other economic activities so that we can easily know how much contribution gives what returns. For example, study shows that government spends about 4000 crore rupees on Kumbh Mela and it generates 12-15 thousand crore rupees of revenue. Prosperity of rivers are crucial for the development and prosperity of the nation, whether on a small scale or on national scale. We therefore need to move away from only tangible economic cost-benefit ratios – from cost based capitalism to value based capitalism. Preliminary research shows that one rupee invested in water-based projects brings back four to five rupees worth of benefits to society - in terms of real monetary benefits.

Typically the present approach in urban water management is water supply, sanitation and sewerage, sewage treatment, drainage, etc. being independently managed by independent

A2: Arth Ganga – River Conservation Synchronized Human Settlement

agencies. We must consider them in totality along with rivers and waterbodies to improve the conditions of our water environment. We, therefore, have to review the capacity of the institutions to deliver at the level of the river basin and also at the level of tributaries from the perspectives of changing climate, constant urbanization and human settlement, and tributaries governance and management. This also involves the mechanism to enhance the participation of local communities by taking a participatory approach and the sharing of responsibilities across different sectors and stakeholders, including private sector, civil society and the government.

India's urban population growth is about 3% per annum. The gap in infrastructure always increases. As per 2011 census, while about 70% of the urban water demand was met, sewerage system and sewage treatment covered only about one-third the urban area, the remaining 67% had no sewerage system. The provision of infrastructure in urban areas is not commensurate with the increase of population. To fulfil the requirement of Swach Bharat Mission in 2014 with modern drainage required about 2.5 lakh crore rupees, which was not possible. Without sewerage the cost was brought down to 63000 crores. But the government of India was able to generate only 40,000 crores. We must, therefore, integrate rivers into city master plans so that city plans are of long-term value. In city planning, 5% of the 20-25% green area should be for perpetual water bodies to be managed locally. Whether for urban sanitation or river cleaning, money once allocated for projects should multiply and sustain the works further on their own.

For comprehensive urban development we have to start preparing service level benchmark for which we need to focus on collecting data. We need a robust system of accounting metrics to collect foolproof data to be the bedrock for many assessments from the tributary level upwards. Only then can we address the question: What can be allocative efficiency for the private sector, agriculture, consumption of water for households and settlement, and for service delivery? And we need to charge for water just as we charge for electricity, for mobile phone usage, television, etc. Water tariff should reflect not just the delivery value of water, but also the scarcity value of water. A basic criteria for water supply should be to supply the basic minimum need at affordable prices and at increasing rates beyond that.

WE NEED A ROBUST
system of accounting metrics to collect foolproof data to be the bedrock for many assessments from the tributary level upwards

IN CITY PLANNING,
5% of the 20-25% green area should be for perpetual water bodies to be managed locally

A2.4. RECOMMENDATIONS

The following major recommendations emerged from the discussions presented above:

1. Arth Ganga means not only extraction from or utilising rivers but also their sustainability because, if rivers or water bodies are lost, no benefits can be obtained from rivers.
2. We have to first correct our attitude – instead of treating a river merely as a water resource, we need to treat it as a living entity.
3. The conflict between conservation and development exists because the mainstream actors of development are select people who have a hardware-oriented approach, while conservation-oriented people are never considered seriously.
4. There is need to develop a methodology to segregate the contribution of river conservation from other economic activities so that we can determine how much contribution gives what returns. We need to move away from only tangible economic cost-benefit ratios – from cost based capitalism to value based capitalism.
5. We must consider urban water management from water supply to sanitation and sewerage to sewage treatment to drainage in totality along with rivers and waterbodies to improve the conditions of our water environment. We, therefore, also need to review the capacity of the institutions to deliver at the level of the river basin and at the level of tributaries.
6. The provision of infrastructure in urban areas is not commensurate with the increase of population, and the gap is increasing. As per 2011 census, about 70% of the urban water demand was met, but sewerage system and sewage treatment covered only about 33% of the urban area.
7. We must integrate rivers into city master plans so that the plans are of long-term value – 5% of the 20-25% green area should be for perpetual water bodies to be managed locally.
8. We have to prepare service level benchmarks for which we must collect foolproof data as the bedrock for a robust system of accounting metrics from the tributary level upwards. Only then can we address the question: What can be water allocative efficiency for the private sector, for agriculture, for households and settlements, and for service delivery?
9. Water tariff should reflect not just the delivery value of water, but also its scarcity value. A basic criteria for water supply should be to fulfil the basic minimum need at affordable prices and at increasing rates beyond that.

A3: Arth Ganga – River Conservation Synchronised Energy and Tourism

DAY 3:
Saturday, December 12, 2020
10:00 – 11:45 hrs

MODE:
Virtual

CHAIR :
Rajiv Ranjan Mishra [NMCG, Ministry of Jal Shakti, GoI]

MODERATORS:
Vinod Tare [Founding Head, cGanga, IIT Kanpur]

PANELISTS:
SK Ratho [Additional Director General of Forests, MoEF&CC, GoI]
Paritosh Tyagi [Former Chairman, CPCB, IDC Foundation]
Arun Kumar [Professor, IIT Roorkee]
R Bhattarai [cGanga, IITK]
Bharat Jhunjhunwala [Freelance Columnist]

A3.1. PROBING THOUGHTS

Developmental activities have often significantly impacted rivers and waterbodies. The effects vary in magnitude in different parts of the Ganga basin depending on local bio-physical attributes and the nature of activities carried out. Adverse impacts on rivers and waterbodies have, however, slowed the developmental momentum in turn, and threaten to slow it down further or even throttle it at times. The need to conserve our rivers and waterbodies is, therefore, essential – both to sustain the developmental surge and to maintain healthy river functioning for their continuing benefits to humans, that is, to maximize the net value of development over the long term. This approach resolves the apparent dichotomy between river conservation and human settlement by embedding the principle of Arth Ganga in the Energy and Tourism development policies and programmes of Central, State and Local Governments.

Energy generation and tourism are two important developmental sectors that are significantly dependent on rivers and also affect rivers. Different types of energy generating alternatives exist in the Ganga basin such as Thermal Power Plants (based on coal, natural gas or other fossil fuels), Nuclear Power Plants, and Renewable Energy Plants (e.g. Hydropower, Wind Energy, Solar Energy, Geothermal Energy, Tidal Energy and Bio-energy Projects). To the extent known, their impacts on rivers and waterbodies – and on the environment in general – are variable. Many types of Power Plants do not consume water as such, but use and/ or discharge considerable amounts of water of poor quality or in a manner that affects rivers considerably. Besides, power plants may also draw upon other natural resources, generate harmful wastes, or affect the local ecology, thereby endangering resource availability, environmental safety and ecological balance in the river basin. A judicious choice of the type and distribution of energy generating plants and their operational strategies are, therefore, essential to safeguard the environment, ensure river conservation, and provide unimpaired developmental impetus.

Tourism in the Ganga basin is significantly woven around rivers and waterbodies. Upland rivers (especially in Uttarakhand State), lakes and wetlands are major tourist attractions in the basin. Their banks and riparian areas are also often the preferred sites of religious institutions that support religious tourism. The growth of tourism in the Ganga basin has been enabled by enhanced road infrastructure, transport systems, recreational facilities, hotels, restaurants and consumer service outlets, local resource consumption, etc. Since many of the tourist spots and/ or their approach routes are located in sparsely populated areas or areas relatively undisturbed by human settlements, the development of tourism infrastructure in such places has had significant adverse impact on rivers and waterbodies in the region. The types of tourism activities to be encouraged are therefore a matter of choice based on their net value in consonance with the value of well-preserved rivers.

The Arth Ganga framework allows for harmonizing Energy and Tourism Development with River Conservation. For this we need to frame the modalities of connecting River Conservation with Energy and Tourism Development.

A3.3. DISCUSSIONS

The global problem of climate change is one that includes rivers because rivers are a component of climate. To overcome the problem as far as rivers are concerned, the concept of Arth Ganga enables us to see river conservation and development as two sides of the same coin which get unified by combining traditional wisdom with modern science. Energy generation – especially of hydropower – is an important development sector that can affect rivers significantly. In the Himalayan uplands of River Ganga, so far only the river valley has been considered for storage of water for hydropower generation, but there is a lot of scope to store water instead in the bowls and gorges of the Himalayas. We also need to look at different options for hydropower – large and micro hydropower plants included – because at many places

A3.2. KEY QUESTIONS

Some key issues of importance on the above subject that need to be deliberated are:

A3: Arth Ganga – River Conservation Synchronised Energy and Tourism

a large plant is relatively less damaging than the cumulative impact of many small plants. One problem with evaluating hydropower projects in India is that the Central Electricity Authority makes no cost-benefit analysis but only looks at their capital costs, whereas the Ministry of Environment, Forests & Climate Change only examines the cost of mitigation but not the total cost and benefits of the project. Thus our regulatory mechanism has incomplete assessment of the costs and benefits of such projects. This is evident from the fact that Uttarakhand state was buying power @ Rs.2.48 in the current financial year whereas the cost of energy from a green-field hydropower project will be between Rs. 7 to Rs.10. Hence cost-benefit analysis is a must for hydropower projects. It should also be noted that one needs water to create energy and energy to move and treat water or heat water; so water and energy are closely interrelated.

Tourism development potential is significant in many regions such as in the Upper Ganga river basin. But when tourism increases there is an exponential increase in energy demand. Energy demand management is therefore important. Also, it may be noted that there are different types of tourism with their specific requirements. For example, the infrastructural and other requirements of religious tourists or pilgrims can be much different from other tourists. To protect and improve the conditions of rivers and river basins from adverse tourism effects, the government has launched widespread afforestation programmes and catchment area treatment plans in major river basins of India. One pressing need is to involve local people in developing tourism and energy generation in sync with river conservation. If local people or communities are also part of such businesses, then they have interest in maintaining the river because that is where they live. It should also be noted that instead of chemical monitoring and online monitoring, bio-monitoring is a much better method for assessing river health.

To meet the goals of above developments synchronised with river conservation, the capacity of NMCG also needs to be enhanced in terms of knowledge and its capability to address many issues such as state of the art techniques on data gathering, information gathering, knowledge gathering, and utilizing the concept of digital India and artificial intelligence, so that we benefit in terms of implementation.

A3.4. RECOMMENDATIONS

The following major recommendations emerge from the above discussions:

1. River restoration is a key component of climate change remediation, and it can be achieved through the principle of Arth Ganga to synchronize development with river conservation.

2. River-sensitive hydropower projects need to consider different options in terms of their total (or cumulative) environmental impact – such as multiple small projects versus a few large projects – before deciding the best option.
3. A complete cost-benefit analysis (with costs including project costs, environmental costs, etc.) is a must for hydropower projects.
4. Storage reservoirs for hydropower projects need not be only in Himalayan river valleys. The possibility to store water instead in the bowls and gorges of the Himalayas may be investigated.
5. When tourism increases there is an exponential increase in energy demand. Energy demand management is therefore important.
6. There are different types of tourism with their specific requirements. For example, the infrastructural and other requirements of religious tourists or pilgrims can be much different from other tourists.
7. Involvement of local people in developing tourism and energy generation can ensure river conservation since local people have their own interest in maintaining the river.
8. Instead of chemical monitoring and online monitoring, bio-monitoring can be a much better method for assessing river health.
9. The capacity of NMCG needs to be enhanced in terms of knowledge and its capability to address many issues such as state of the art techniques on data gathering, information gathering, and knowledge gathering.

INSTEAD OF CHEMICAL

monitoring and online monitoring, bio-monitoring is a much better method for assessing river health

A4: Arth Ganga – River Conservation Synchronised Agriculture

DAY 5:
Monday, December 14, 2020
10:00 – 11:45 hrs

MODE:
Virtual

CHAIR :
Rajiv Ranjan Mishra [NMCG, Ministry of Jal Shakti, GoI]

MODERATORS:
Vinod Tare [Founding Head, cGanga, IIT Kanpur]

PANELISTS:
Ajay Pradhan [President & CEO, C2S2, New Delhi]
Suresh Babu SV [Director- River Basin & Water Policy, WWF-India]
Prasanta Sanyal [Professor, Department of Earth Sciences, Indian Institute of Science Education and Research (IISER), Kolkata]
SP Singh [Professor, Department of Humanities and Social Sciences, IIT Roorkee]
Ashish Pandey [Professor, Water Resources Development and Management Department, IIT Roorkee]
R Bhattarai [cGanga, IIT K]

A4.1. PROBING THOUGHTS

Developmental activities have often significantly impacted rivers and waterbodies. The effects vary in magnitude in different parts of the Ganga basin depending on local bio-physical attributes and the nature of activities carried out. Adverse impacts on rivers and waterbodies have, however, slowed the developmental momentum in turn, and threaten to slow it down further or even throttle it at times. The need to conserve our rivers and waterbodies is, therefore, essential – both to sustain the developmental surge and to maintain healthy river functioning for their continuing benefits to humans, that is, to maximize the net value of development over the long term. This approach resolves the apparent dichotomy between river conservation and human settlement by embedding the principle of Arth Ganga in the agricultural development policies and programmes of Central, State and Local Governments. Agricultural growth in past centuries in the Ganga basin was aided primarily by canal irrigation that added crop cycles and cropping areas. Thereafter, with the advent of deep tube wells, agrochemicals (chemical fertilizers and pesticides), modern farm machinery, and high-yielding crop varieties, the Green Revolution enabled rapid growth in agriculture since the Nineteen Seventies. Such growth has added considerable economic value to the products due to increase in production of staple crops as well as cash crops like sugarcane. It is likely, however, that the soil productivity may have actually decreased, considering the overexploitation of natural resources like water, soil nutrients and soil biodiversity, and further loss of soil fertility due to chemical inputs. Consequently, the natural environment, including rivers and waterbodies, have also been affected through increased pollutant discharges (such as reactive nitrogen and phosphorous), freshwater depletion, and soil erosion. Such negative effects on rivers and waterbodies (including groundwater) have, in turn, becoming a constraint on sustaining agricultural growth. Alternative agricultural practices that economize on valuable inputs and/ or raise agricultural product value while helping conserve both land productivity and the natural environment such as crop diversification, mixed cropping, organic farming, conservation agriculture (no-tillage farming), improved water management in rice cultivation by alternate wetting and drying, optimal fertilizer use by deep placement methods, raised-bed farming, use of bio-fortified seeds, landscape-scale resource conservation measures, and even horticultural growth are limited in the Ganga basin. Synchronizing agricultural development with river conservation is, thus, a boon for both the goals of long-term agricultural development and river conservation..

A4.2. KEY QUESTIONS

Some key issues of importance on the subject that need to be discussed are:

1. **What have been the agricultural development trends, and what are their shortcomings in coordinating development with the conservation of rivers and waterbodies?**
2. **What are the alternative developmental options and their linkages to river conservation?**
3. **What are the bottlenecks in adopting these alternative developmental options?**
4. **Which alternative development options are likely to increase the long-term net value of agricultural development-plus-rivers?**
5. **Can local communities, ordinary citizens and disparate small stakeholders be empowered to play active roles in integrating such development with river conservation?**
6. **What monitoring and evaluation mechanism should be adopted to synchronize agricultural development with river conservation?**
7. **What policies and programmes should be adopted to integrate agricultural development with river conservation at national, state and local levels?**

A4.3. DISCUSSIONS

The three most important things for river restoration and conservation are: (i) to have good understanding of the river and its critical issues, (ii) to communicate that understanding effectively to all stakeholders, and (iii) to negotiate with the stakeholders. River restoration and conservation should adopt a bottom-up approach that is, first working with lower order streams, then middle order streams and tributaries, and finally the main-stem river. The overall policy framework and understanding can come from top, but actual implementation has to start from the bottom upwards. Hence we should create

A4: Arth Ganga – River Conservation Synchronised Agriculture

many empowered bodies for every small river, not just for the entire Ganga River basin. In agricultural management local and district-level officials are often unaware of water use efficiency, irrigation management, groundwater management, overall water situation in the area, or the virtual water component in agricultural produce (e.g. about 2500-3000 liter water is consumed per kg of rice produced). Hence, generating requisite information and making it easily accessible and usable for stakeholders is essential. "Krishi Vigyan Kendra"s (KVKs) in several districts of U.P. have adopted many alternative agricultural practices with better water efficiency, but without understanding hydrology or hydrogeology. To transform the KVKs into centres of excellence, Arth Ganga can be a platform to increase efficiency, groundwater productivity, farm yields, and economic development of farmers. Promoting sustainable, best management practices for irrigation and agriculture should trickle down to the lowest farm level, which will also benefit river conservation. For this to happen we need not only an interdisciplinary approach, but also a participatory approach to minimize water and fertilizer usages, soil degradation, etc. Micro-water equilibrium concept should also be applied to – not only improve local ecology – but also local groundwater and irrigation water availability. Surface water storages should lead to substantial infiltration and groundwater recharge so that the micro-level water equilibrium is maintained. In making river basin plans with environmental flows, water allocation priorities for consumers should be clearly outlined. Moreover, saving water in irrigation may cause some hardship, hence farmers adopting water-saving measures need to be appropriately compensated. Promotion of urban agriculture is also very important. Some urban areas should be designated for agricultural use, especially for horticulture, to produce at least one-third the local need, and such designated areas should be integrated in urban planning along with the construction of lakes and the treatment of grey water. In rural areas there is also a need to halt the conversion of wetlands to agricultural farms and to keep wetlands intact and in good condition. Agricultural soil degradation can be avoided by adopting "mridahin krishi", that is "soilless agriculture". Pollution of groundwater and surface waterbodies is often attributed to agricultural runoff and leachate, but actual evidence is scarce. Fingerprinting methods (such as isotopic techniques) are now available to identify the source of particular pollutants.

THE OVERALL

policy framework and understanding can come from top, but actual implementation has to start from the bottom upwards

A4.4. RECOMMENDATIONS

The following major recommendations emerged from the discussions presented above:

1. To enable comprehensive river restoration and conservation, implementation of restorative measures should start from small rivers to large tributaries to the main-stem river through the establishment of empowered multiple river basin bodies for each small and large river.
2. Generating requisite information on agricultural water usage and hydrological and hydro-geological status of an area, and sharing such data with stakeholders, are essential to promote sustainable best-management practices in agriculture.
3. Both the interdisciplinary and participatory approaches are required to minimize water and fertilizer usages as well as soil degradation with optimal agricultural productivity.
4. Maintaining the micro-level water equilibrium in an area improves both the local ecology and the local water availability, thereby reducing dependence on river water.
5. River basin plans with environmental flows should clearly outline the water allocation priorities.
6. Promotion of urban agriculture, especially horticulture, should be integrated in urban planning with designated areas to produce at least a third of urban horticultural needs.
7. There is pressing need to halt the conversion of rural wetlands to agricultural farms, and to maintain the wetlands in good condition.
8. Agricultural soil degradation and possible waterbodies' pollution can be avoided by adopting "mridahin krishi", that is "soilless agriculture".
9. Fingerprinting methods (such as isotopic techniques) are available to identify the source of particular pollutants, and they should be used to determine if agricultural sources are a cause for the pollution of waterbodies.

A5: Arth Ganga – River Conservation Synchronised Inland Water Navigation and Flood Management

DAY 6:
Tuesday, December 15, 2020
10:00 – 11:45 hrs

MODE:
Virtual

MODERATORS:
Vinod Tare [Founding Head, cGanga, IIT Kanpur]

PANELISTS:
RK Sinha [Vice Chancellor, Shri Mata Vaishno Devi University (SMVDU)]
CKL Das [Member (C), Ganga Flood Control Commission]
Basant Das [Director, Central Inland Fisheries Research Institute, CIFRI]
Sanjay Gangwar [Member Technical, Inland Waterways Authority of India, IWAI]
Sher Singh [Member (P), Ganga Flood Control Commission]

A5.1. PROBING THOUGHTS

Developmental activities have often significantly impacted rivers and waterbodies. The effects vary in magnitude in different parts of the Ganga basin depending on local bio-physical attributes and the nature of activities carried out. Adverse impacts on rivers and waterbodies have, however, slowed the developmental momentum in turn, and threaten to slow it down further or even throttle it at times. The need to conserve our rivers and waterbodies is, therefore, essential – both to sustain the developmental surge and to maintain healthy river functioning for their continuing benefits to humans, that is, to maximize the net value of development over the long term. This approach resolves the apparent dichotomy between river conservation and human settlement by embedding the principle of Arth Ganga in flood management and navigation development policies and programmes of Central, State and Local Governments.

Major inland navigational routes in the Ganga basin are limited to some of the main river stretches in the Ganga plains and in some of the smaller rivers and canals in the Ganga delta region in West Bengal. However, many rivers and canals in the basin may have the potential to be developed as inland waterways for commercial navigation, at least in the non-monsoon season. This potential is significant in Bihar, wherein the entire stretch of River Ganga is itself part of the National Waterway from Allahabad (Prayagraj) to the mouth of the river in the Bay of Bengal. With governmental initiative to fully develop this National Waterway through a number of off-stream or near-stream facilities (like ports, docks, jetties, embankments, river training works, and road connections) and in-stream works (like weirs, gates, dredging, riverbed modifications, etc.), the river network in Bihar and elsewhere is likely to get a further boost to develop as commercial waterway. With these developments, inland water navigation – especially for transport of cargo – is likely to provide significant economic gains for the region. Simultaneously, they are likely to have possible adverse impacts on the riverine environment. Navigation development, therefore, needs to be linked with river conservation for net gains on the two fronts combined.

River floods are a recurring and grievous problem in many parts of the Ganga river basin, especially with Himalayan rivers being in spate during spells of heavy rain in the monsoon season. This problem is pronounced in several states, such as in Bihar – with the Rivers Kosi, Baghmati and other Himalayan tributaries of the Ganga – and River Ganga herself – being the cause of widespread flood damage including the loss of life and property of millions of people. Despite many efforts over the decades – including levees and channelization – the flood problem in Bihar has remained acute; perhaps they have even increased in intensity and extent in recent decades. This increase in floods has been attributed to a number of possible reasons such as heavier rainfall events (potentially due to climate change), increased silt load in rivers due to soil erosion in deforested upstream catchments, increased runoff rates from catchments due to loss of vegetal cover and increased built up surfaces, reduction in stream slope due to tectonic uplift and subsidence, increased floodplain encroachments causing greater flood submergence, and higher flood levels due to increased riverbed siltation caused by downstream dams or barrages. Until the real causes of such floods can be ascertained and neutralized, flood mitigation may remain a herculean task. The solution obviously lies in appropriate flood management measures ranging from engineering measures like embankments, channelization, de-silting, dredging and dam operations to catchment improvement measures like clearing human encroachments from floodplains, reviving the floodplain wetlands and vegetal cover, clearing the runoff drainage routes, and reducing soil erosion from agricultural tillage and other deleterious land-uses. Simultaneously, the impacts of such measures on rivers and waterbodies need to be assessed to ensure river conservation and maximize the goods and services provided by rivers.

A5.2. KEY QUESTIONS

The above two developmental and management activities evidently need to be synchronized with river conservation for best returns in line with Arth Ganga. Some key issues of importance on the subject that need to be discussed are:

- What are the trends in inland water navigation development and flood management, and what are their shortcomings in coordinating development with the conservation of rivers and waterbodies?
- What are the alternative developmental options and their linkages to river conservation?
- What are the bottlenecks in adopting these alternative developmental options?
- Which alternative development options are likely to increase the long term net value of inland water navigation development and flood management-plus-rivers?
- Can local communities, ordinary citizens and disparate small stakeholders be empowered to play active roles in integrating such development with river conservation?
- What monitoring and evaluation mechanism should be adopted to synchronize inland water navigation development and flood management with river conservation?
- What policies and programmes are needed to integrate inland water navigation development and flood management with river conservation at national, state and local levels?

A5: Arth Ganga – River Conservation Synchronised Inland Water Navigation and Flood Management

A5.3. DISCUSSIONS

Inland water navigation is economically very important in the Ganga basin, particularly in the Ganga River stretch from Allahabad to Ganga Sagar; hence synergising healthy river functioning with navigation is a definite need. Likewise, floods occur extensively in the lower part of the Ganga basin, particularly in Bihar and West Bengal, causing enormous damage to life and property. Flood control and mitigation are, therefore, also economically very significant, besides being of humanitarian concern. But flood management measures need to be in sync with river conservation. "Jan Gyan" (people's wisdom) and "Gyan Dhara" (traditional knowledge, modern scientific understanding, and field experience combined) can help strengthen the Arth Ganga framework for comprehensive navigation and flood management.

Navigation needs to be aligned with river conservation and, hence, with river biodiversity, that is, the entire consortium of biota from mammals (like the Gangetic Dolphin) to fish to smaller animals to plants and microbes. The biggest problem for navigation in River Ganga is low flows, there being hundreds of locations where the water depth is below 1.5 m during the lean season, unsuitable for commercial navigation. These spots are mostly between Patna and Banaras where the river morphology is very dynamic and river channels keep on changing every year, with 3-4 parallel channels in the lean season. Hence the rivers must have more discharge to ensure adequate depth. This has to be done by bringing back river waters diverted for irrigation in Uttar Pradesh state (Ganga waters being barely used for irrigation in Bihar and West Bengal) where uncontrolled flood irrigation is adopted for rice and wheat crops. Another method is to ensure that at least one of the several parallel channels has the required depth wherever the river is braided. In one such 11 km stretch downstream of Banaras the depth used to be only 1.5 m or less than 1.5 m in all channels. Using an eco-friendly method of bottom bamboo panels, the silt was diverted to secondary channels during flood times so that the main channel was not silted. That main channel has sustained a minimum depth of 3 m for the last 10 years. Vetiver grass can also be used to prevent or minimize bank erosion and to help fish to spawn and breed. The net impact of these measures is eco-friendly socio-economic development along with river navigation. But dredging is also a last option that may be occasionally needed in a few places though it is felt that dredging may disturb the entire river ecosystem.

Similarly as for navigation, flood management infrastructure must be aligned with river ecology and also from the perspective of safety for riparian settlements. But conventional flood control measures, especially embankments, have snapped the lateral connectivity of rivers with floodplain wetlands and tributaries. In the 1950s the total length of embankments in Bihar was barely 100-125 kms while the flood-prone area was about 25 lakh hectares, but by the 1980s embankments were more than 3000 km while the flood-prone area had increased to 68 lakh hectares. Moreover, if floods receded within a matter of days in earlier times, flood waters reside in the floodplains for months together at present. These data clearly demonstrate that embankments and other such measures are no solution for flood control. One reason for these increases in flood problems may be the high silt load coming from upland rivers in Nepal which may have caused the riverbeds in Bihar to elevate, besides reducing river flow velocities. But the downstream Farakka Barrage in West Bengal may also be a cause for riverbed rise. The current river infrastructure therefore needs to be reviewed in terms of comprehensive silt management to minimize river floods in Bihar.

> **"JAN GYAN" (PEOPLE'S WISDOM)**
>
> **and "Gyan Dhara" (traditional knowledge, modern scientific understanding, and field experience combined) can help strengthen the Arth Ganga framework for comprehensive navigation and flood management**

A5.4. RECOMMENDATIONS

The following major recommendations emerged from the discussions presented above:

1. Inland water navigation is economically very important in the Ganga basin, hence synergising healthy river functioning with navigation is a definite need.
2. Flood control and mitigation are also economically and socially very important, but flood management measures need to be in sync with river conservation.
3. The Arth Ganga framework for comprehensive navigation and flood management can be adopted through the combination of "Jan Gyan" (people's wisdom) and "Gyan Dhara" (traditional knowledge, modern scientific understanding, and field experience combined).
4. The biggest problem for navigation development in River Ganga is low flows, with many locations having water depth below 1.5 m during the lean season, which is unsuitable for commercial navigation. To overcome this problem, Ganga water diversion for wasteful irrigation in Uttar Pradesh should be curtailed and returned to the river.
6. In braided river stretches, an eco-friendly method of bottom bamboo panels to ensure that at least one of several parallel channels has the required depth of at least 1.5 m can be adopted.
7. Vetiver grass can be used to minimize bank erosion and to help fish to spawn and breed.
8. Dredging of riverbeds to provide required channel depth may disturb the entire river ecosystem, and hence should be avoided or used only as a last option.
9. The total length of embankments in Bihar increased nearly 30-fold since the 1950s to more than 3000 km in the 1980s, but the flood-prone areas increased simultaneously from 25 lakh hectares to 68 lakh hectares, proving the fallacy of embankments and other conventional measures for flood control.
10. The increased flood problems in Bihar may be due to increased high silt load coming from upland rivers in Nepal which may have caused the riverbeds in Bihar to elevate, besides reducing river flow velocities. The increased flood problems in Bihar may also be due to the downstream Farakka Barrage. The actual problems need to be studied and identified.
11. The current river infrastructure needs to be reviewed in terms of comprehensive silt management to minimize river floods in Bihar.

TRACK B

DAY 1:
Thursday, December 10, 2020
16:00 –17:45 hrs

MODE:
Virtual

CHAIR:
Rozy Agarwal [ED (Finance), NMCG]

MODERATOR:
Sanmit Ahuja [Expert, cGanga, IITK]

PANELISTS:
Madhava Kumar R [Sr. Eco Fin. Expert, NMCG]
Liran Dor [Boson Energy]
Hirander Misra [Chairman, GMEXGroup, UK]
Avinandan Taron [Economist, IWMI]
Sudhir Kumar [NITI Aayog]
Palash Srivastava [IIFCL Projects]
Navneet Mairal [COO, iGreensphere]
Xavier Chauvot De Be [World Bank]
James Close [Head of Programme, Circular London, UK]
Ken Jones [MD Exo-Cubic Solutions, UK]

Models to Finance Circular Economy

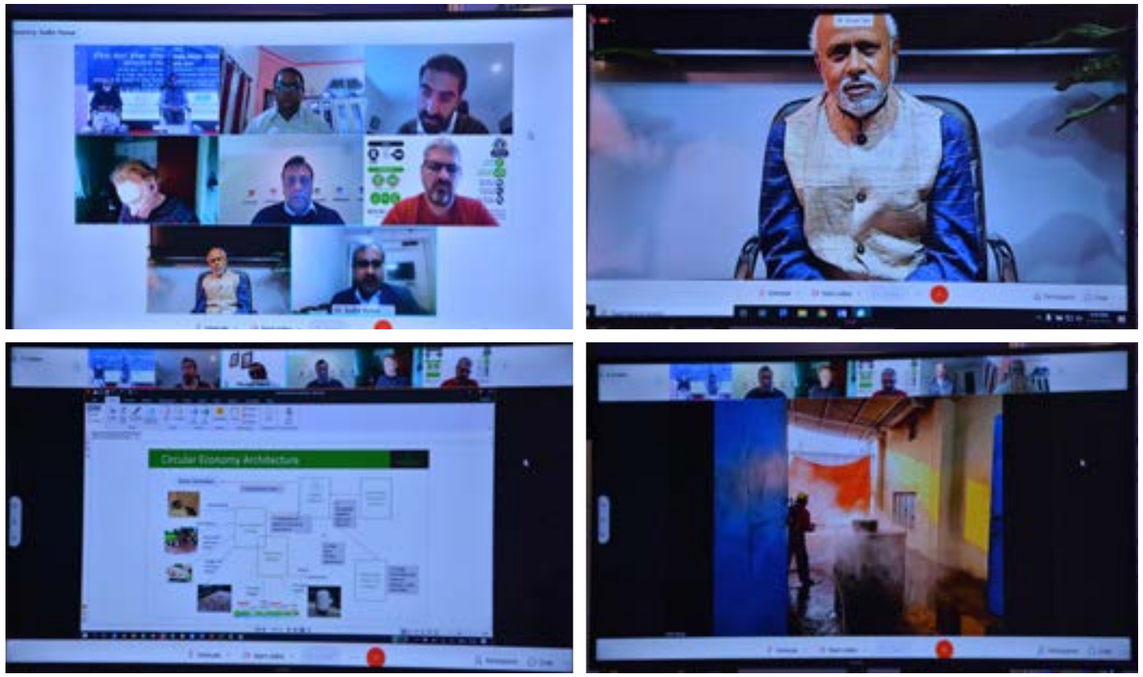
ACTION POINTS

Explore sector coupling scenarios where waste of one sector can become a resource for the other. Initiate the first such coupling: from waste to hydrogen.

Immediately prepare and implement a pilot project that enable circular economy trading in wastewater by creating a local area water market.

Partner with commodity investors and aggregators who can bring in capital into the value chain of the circular economy.

- Implementation of circular economy in waste-water treatment principally requires creation of a water market.
- A stringent policy support to start water markets id with use of sludge to recover energy and fertilizers, followed progressively by creating market for wastewater.
- There is a huge opportunity to introduce the recycle/reuse principles of wastewater, but lack of pricing mechanism prevented the market to develop.
- Policy support is needed to first develop a value for water followed by costs and pricing structures that will vary from case to case.



HUGE OPPORTUNITY

to introduce the recycle/reuse principles of wastewater, but lack of pricing mechanism prevented the market to develop

Strengthening HAM and PPP Framework in the Water Sector

DAY 2:
Friday, December 11, 2020
16:00 –17:45 hrs

MODE:
Virtual

CHAIR:
Rajiv Ranjan Mishra [DG, NMCG]

MODERATORS:
Rozy Agarwal [ED (Finance), NMCG]
Sanmit Ahuja [Expert, cGanga, IITK]

PANELISTS:
Madhava Kumar R [Sr. Eco Fin. Expert, NMCG]
SK Saha [NITI Aayog]
Haresh Mehta [Adani Group]
Kushal Kumar Singh [Deloitte]
Sourav Daspatnaik [CEO, Swachh Environment]
Praveen Sethia [Director, Infrastructure Advisors Group]
Howard Barrie [Partner, Dentons]
Rajiv Mittal [CEO, Wabag]
Neeraj Gupta [IFC]

- The introduction of Hybrid annuity model framework in the wastewater sector has enabled the implementation of projects and jumpstarted the involvement of private sector in this sector.
- In some cases, financial closures are not happening fast enough largely due to many constraints outside the control of developers such as rehabilitation, land acquisition etc. This requires concerted effort on part of NMCG and State Governments to address the issues prior to project bids being brought online.
- HAM cannot be the answer to all projects in the sector and the Government will not have the resources to finance every project in the wastewater treatment sector. It needs creation of water markets supported by policy framework on water valuation, recycle and reuse.

WASTEWATER
treatment sectors needs creation of water markets supported by policy framework on water valuation, recycle and reuse

ACTION POINTS

Troubleshoot the issues around most common conditions precedents required by lenders prior to launching the project. Share the knowledge with wider industry.

Utilise government investment into creating a larger water market to enable more investors and market participants. Establish economic value for water followed by a financial value.

Encourage ULBs to start finding ways to bring the assets or value derived from water on to their balance sheet.

Financing Technology Commercialisation

DAY 3:
Saturday, December 12, 2020
16:00 –17:45 hrs

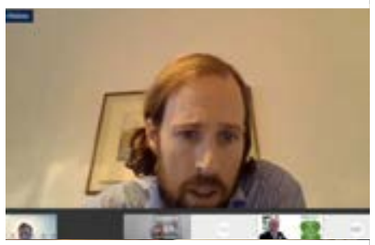
MODE:
Virtual

CHAIR:
Rajiv Ranjan Mishra [DG, NMCG]

MODERATORS:
Rozy Agarwal [ED (Finance), NMCG]
Sanmit Ahuja [Expert, cGanga, IITK]

PANELISTS:
Munish Diwan [Director, Tulip Energy Private Ltd]
Jan Grimbrandt [CEO/ Founder, Boson Energy SA]
Rahul Mehta [MD, Mentor Capital]
Daniel Scholten [Partner, Procel Capital,Germany]
Simon Harris [Principal, Quantum Investment Group, UK]
Jayeis Sonill [CEO, AUM Capital]
Vinod Tare [Head, cGanga, IITK]

- For path-breaking technologies, inventors should not be asked for performance track record or reference sites specifically in India, as this prevents technological advancement.
- Establishing a regulatory framework can create a major demand side pull for accelerating new technologies to market.
- Where the product can be consumed directly by the consumers, a possible source of funding or early adopters could be those industries already manufacturing consumer products e.g. packaged water.
- Venture capital finds it difficult to finance as the investment thresholds are high. There are smarter ways to finance the gaps created by lack of venture capital. Government can connect entrepreneurs to its existing assets such as universities (for trials), public sector utilities can be platforms for pilot projects.
- Government putting strategic bets on global high priority trends such as circular economy and establishing high visibility pilot projects can attract global capital base thereby accelerating technology commercialisation.



ESTABLISHING
a regulatory framework can create a major demand side pull for accelerating new technologies to market

ACTION POINTS

More exchange forums for bringing entrepreneurs together with wider ecosystem, particularly get sector coupling going.

Establishing a dedicated fund for supporting high impact projects.

Back sectors where there is much global interest.

Provide regulatory support in areas of high environmental impact.

Capital Markets for Water Financing

SUSTAINABILITY

bonds fit perfectly between the green bonds and social bonds segment. They conform very much to the Arth Ganga framework of sustainable development

DAY 5:
Monday, December 14, 2020
16:00 –17:45 hrs

MODE:
Virtual

CHAIR:
Rajiv Ranjan Mishra [DG, NMCG]

MODERATORS:
Rozy Agarwal [ED (Finance), NMCG]
Sanmit Ahuja [Expert, cGanga, IITK]

PANELISTS:
PR Jaishankar [MD IIFC]
Pawan Singh [PTC Financial Services]
Joel Kolker [Program Manager, GWSP]
Rajesh Miglani [IFC]
Ajay Mehta [YES Bank]
Joywin Mathew [Partner, Dentons, UK]
Hirander Misra [Chairman, GMEX Group, UK]
Jessica T. Naga [Partner, Digital InfrastructureFund, Mauritius]
Xavier Chauvot De Be [World Bank]
Madhav Kumar R [Sr. Eco Fin. Expert, NMCG]

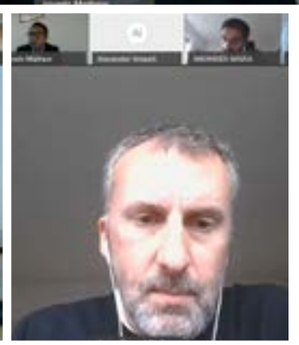
- The bond markets in India only subscribe to top investment grade paper and as a result only 15-20% of financing needs are catered by the bond markets whereas in many other nations more than 50-60% of financing come from bond markets.
- India's growth aspirations can only be funded by growth in infrastructure investments and the banks just do not have the capacity to take on the financing needs of this growth. Capital markets are the only source of financing. For that a new financial architecture or a financial continuum needs to be created so that all stages of financing are visible and available to investors and project developers.
- There is also no issue with capital availability. The underlying issue is the credit worthiness of the borrower and the structuring of the project. Getting the fundamentals in place is an absolute must and the capital will follow.
- A good communication and signalling strategy must be developed particularly around the underlying risk in water projects. A lot of the investors still do not understand what are the risks in the water sector.
- Water sector has both revenue and non-revenue generating segments. Whilst both can be funded through capital market segments, the revenue generating segment will grow faster with the help of credit enhancement instruments.
- NMCG as an issuer coming to market will be a very compelling proposition to prospective investors globally. It will help financing even non-revenue generating water through impact bonds, and more importantly demonstrate a credit curve to the various market participants.
- Sustainability bonds fit perfectly between the green bonds and social bonds segment. They conform very much to the Arth Ganga framework of sustainable development.
- It is important to also develop a framework with an independent external reviewer on use of proceeds of the funds to give the transparency and visibility to investors.
- New instruments such as tokenisation allow democratisation of investments. Many retail investors can get connected with the river conservation and water projects.
- The concept of Digital Ganga Bond is promising.

ACTION POINTS

Pilot a Ganga sustainability bond.

Establish framework for NMCG to be an issuer to establish credit curve.

Capital Markets for Water Financing



Capital Markets for Water Financing

DAY 6:
Tuesday, December 15, 2020
16:00 –17:45 hrs

MODE:
Virtual

CHAIR:
Rajiv Ranjan Mishra [DG, NMCG]

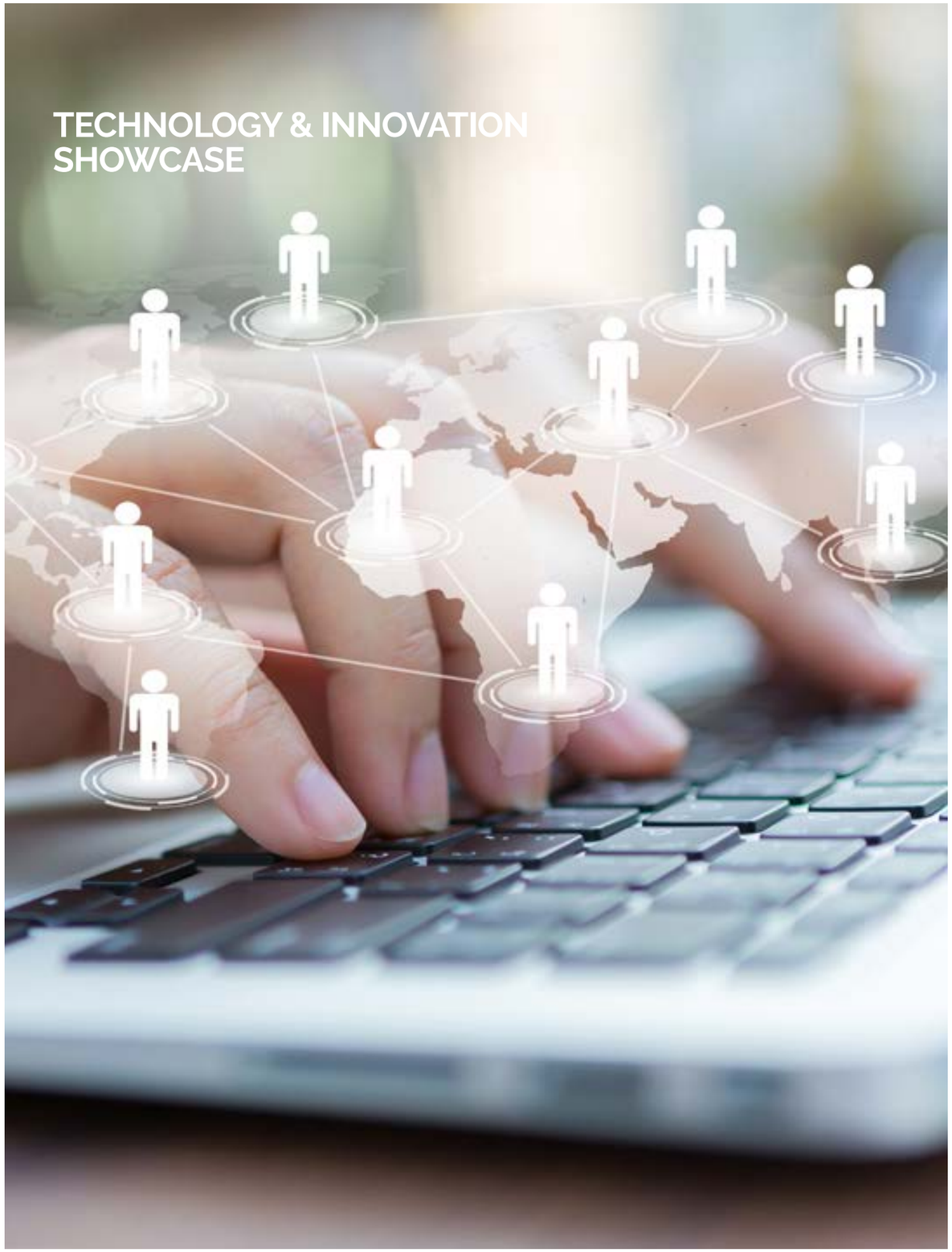
MODERATORS:
Rozy Agarwal [ED (Finance), NMCG]
Sanmit Ahuja [Expert, cGanga, IITK]

PANELISTS:
Satish Sundarajan [World Bank]
TN Giridhar [SSG Capital, UK]
Madhav Kumar R [Sr. Eco Fin. Expert, NMCG]
Donald Cannen [European Investment Bank]
Satish Menon [USAID]
Sreeni [Agvesto London]

- To unlock the liquidity from capital markets, the investors into projects during the development and construction phase need adequate security cover and financial guarantees. There are a number of such alternative instruments which when brought in can truly accelerate project finance. The relevant topics are:
  - ✓ Construction guarantee instruments
  - ✓ Insurance wrappers
  - ✓ Credit enhancement instruments
  - ✓ First-loss instruments
- Achieving financial closure for project developers is a momentous moment.
- Whilst capital injection by the equity investor(s) and senior lender(s) plays the most prominent role in project finance, there are many other supporting but important financing structures that enhance the credit ratings of the projects thereby enabling access to capital.

THE INVESTORS
into projects during the development and construction phase need adequate security cover and financial guarantees

SESSION C



DAY 1:
Thursday, December 10, 2020
14:00 – 16:00 hrs

CHAIR:
M Jawed [Professor, IIT Guwahati]

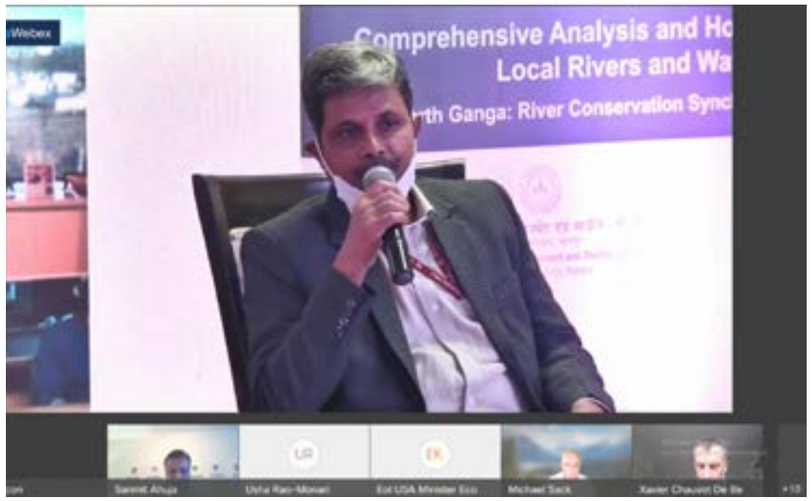
CO-CHAIR:
DP Mathuria [ED (Technical), NMCG]

MODERATOR:
Sundeep Singh Chauhan [Expert, cGanga]

CO-MODERATOR:
Mr Daniel Scholten [Arkatap]

EXPERTS:
MM Ghangrekar [Professor, Indian Institute of Technology Kharagpur]
Absar Ahmad Kazmi [Professor, Indian Institute of Technology Roorkee]
BR Gurjar [Professor, Indian Institute of Technology Roorkee]
K Sri Harsha [Co-founder, Kritsnam Technologies]
M Mansoor Ahammed [Professor, SVNIT Surat]
S Shrihari [Professor, National Institute of Technology Karnataka Surathkal, Surathkal]
B Sikka [Senior Consultant, NMCG]
Vinay Kumar [Professor, Indian Institute of Technology Roorkee]
Ashish Mathur [Advisor, Grant Thornton]
Surya S Durbha [Professor, Indian Institute of Technology Bombay]
Pawan K Labhasetwar [Sr. Principal Scientist, NEERI Nagpur]

SESSION CHAIR



PANELISTS

Ashish Mathur | K Sri Harsha | Pawan K Labhasetwar | Sundeep Singh Chauhan | AA Kazmi

M Mansoor Ahammed | S Shrihari | Surya S Durbha | BR Gurjar | MM Ghanghrekar

SESSION C1 | SESSION C2 | SESSION C3 | SESSION C4 | SESSION C5 | SESSION C6

Technology & Innovation Showcase

M/S Nanofique Limited, UK

Products and processes
- Nanofique biocomposite
- Photocatalysis
- Removal & upgrade of Heavy metal ions
- Nanobubbles
- Removal & upgrade of salt
- Sensors – water testing
- Antifouling coatings

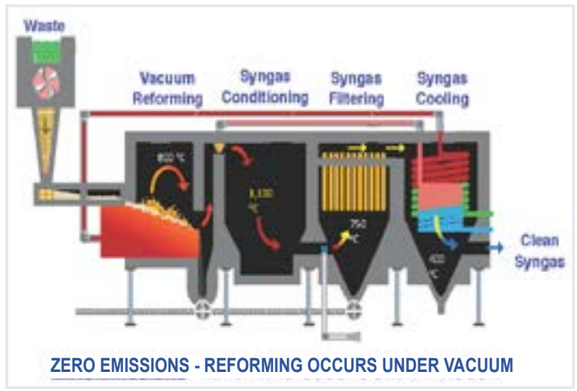
Antifouling non-stick coatings
- Fouling represents a problem in wastewater treatment equipment.
- We supply antifouling coatings.

Nanofique Limited: Novel products and processes for industrial wastewater treatment
Main focus areas: • Denim dyeing • Denim wash plants

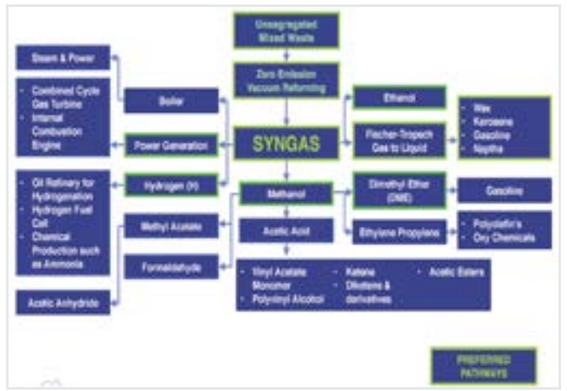
Mr. Richard Burke

Mr. Richard Burke (CEO) made a presentation highlighting *Nanofique cGanga Technology Overview* with main focus on industrial wastewater treatment from textile industry such as denim dyeing and denim wash plants. Biocomposites and photocatalysis have been used for textile wastewater decolourization. In addition, nanobubble technology which supplies ultra-fine oxygen bubbles, has been claimed to speed up aerobic biodegradation with enhanced catalytic and photocatalytic processes. Even salts used in processes can be recovered and upgraded for reuse. They also developed multi-sensors for contamination measurements. The cost of textile wastewater treatment for decolourization is around 1 US$ per m^3 of wastewater. A pilot is coming up in Turkey which shall probably give field level data for the performance of some of these technologies. Early stage and thus field data from Turkey is vital to consider for ETV perhaps next year.

M/S Hope Resources, UK



Vacuum Reforming: Simple schematic of waste to syngas



The Value of Syngas: Alternative uses

A presentation entitled *Converting Mixed Waste to Sustainable, Environmental Fuels* was made by Mr. Christopher Toureau (Co-Founder). Hope Resources has developed a vacuum reforming process that converts organic carbon based materials, such as waste plastics, tyres, mattresses, sewage sludge, card/paper, construction waste etc. into ultra clean syngas and 'ash'. It is capable to process mixed unsegregated waste streams with zero emissions to produce syngas. The process operates in a closed environment, at negative pressure and emits nothing to the environment. The syngas can then be processed using off-the-shelf technology to produce a number of valuable outputs such as low sulphur fuel oils, fuel cell grade hydrogen, fertiliser etc. Minimum size of the modular unit can handle around 50 kg of wastes per hour or 25,000 tons /annum and may not require any segregation of the waste.

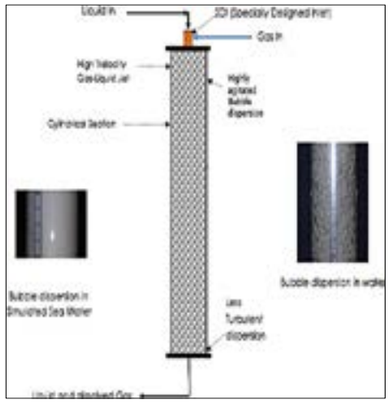
Mr. Christopher Toureau

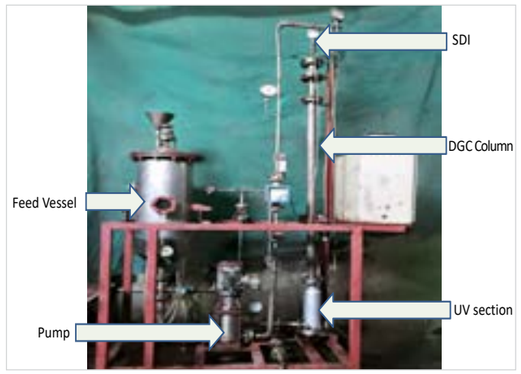
Technology & Innovation Showcase

M/S WRK Design & Services Ltd, UK & STEP Pvt Ltd, Mumbai, India

OUR PRODUCT- DGC

- DGC is a downflow co-current device for efficient gas-liquid mass transfer.
- It consists of a cylindrical section with a Specially Designed Inlet (SDI) at its entry (at the top), allowing both liquid and gas into the reactor
- SDI is the heart of the technology.
- High velocity liquid input through the SDI generates intense shear & energy which produces highly agitated gas-liquid dispersion with increased interfacial area & improved mass transfer.
- DGC can be operated at high pressure & temperature; and in batch & continuous mode.





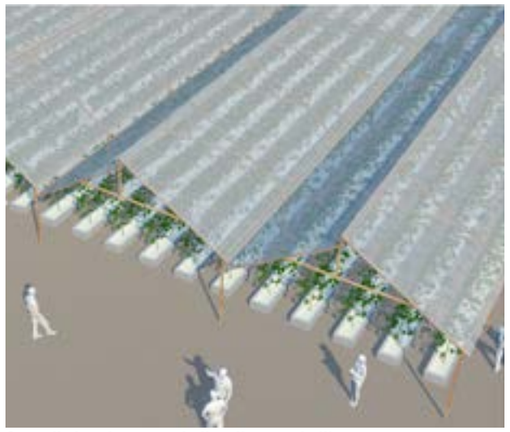
Skid Mounted Pilot Plant - India

Dr. S Raymahasay

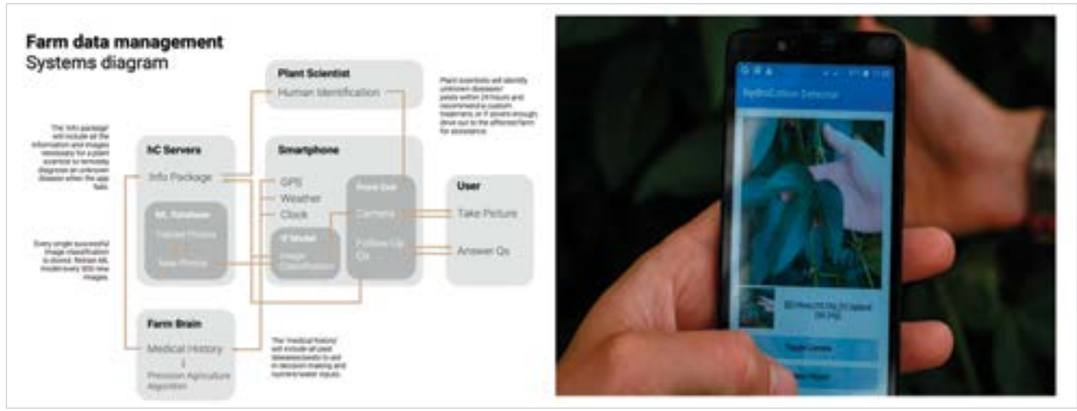
Dr. Deepale Palekar

Dr. S Raymahasay and Dr. Deepale Palekar (Director) jointly presented *DGC (Downflow Gas Contactor) Technology: A Novel Reactor for Effluent Treatment, Biogas Upgradation, Carbon Capture, Chemical Reactions and Gas Scrubbing.* The DGC column reactor is a very efficient mass transfer gas-liquid contacting/ absorption device, where a gas and liquid stream are introduced simultaneously through a specially designed inlet (SDI) section at the top of a fully flooded column. This high velocity inlet jet stream generates intense shear and energy producing a vigorously agitated gas-liquid dispersion in the upper section of the column. This shear causes the break-up of any gas pocket at the inlet and allows the formation of a vigorously agitated gas-liquid dispersion zone with a very high interfacial mass-transfer area in a small operating volume. With a simple, compact, flexible design and easy scale-up, use of the DGC reactor allows shorter operating and contact times, lower energy requirements, reduced capital and lower operating costs and a smaller footprint. The 'DGC' can be designed and operated at any required pressure. The opex is in the range of Rs. 8-10 to 30-35 per m^3 of waste. At the moment, the DGC can handle a smaller loadings and there is a need to work on scaling it up to be application in the field. This technology has been claimed to receive many international awards and is termed as a green technology. STEP has signed an agreement with WRK to develop DGC technology at commercial level in India & Asia-Pacific. This sounds novel and may be probed on suitability for multiple sectors and applications for commercial applications.

M/S Hydrocotton, UK



Controlled environments buffer climate volatility



Mr. Edward Brial (CEO) made a presentation on *hydroCotton – Good cotton doesn't have to cost the earth.* Hydrocotton uses controlled environments and data driven agriculture radically improving farm efficiency, reliability and sustainability. Precision irrigation allows application of nutrient rich water directly to the plants root zone. Crop gutters capture excess water allowing it to be circulated back to reuse. Hydrocotton farms use 'white label' multispan, plastic covered greenhouses (with wooden or steel frames). Hydrocotton uses AI/ML technology with mobile app to control the farm operations based on collected data sets. The app is easy to use and encourages farmers to make data driven decisions. Promising and if commercially viable, could mitigate Aral Sea type of disaster, where diversion of water for cotton irrigation dried up the sea causing a monumental environmental disaster.

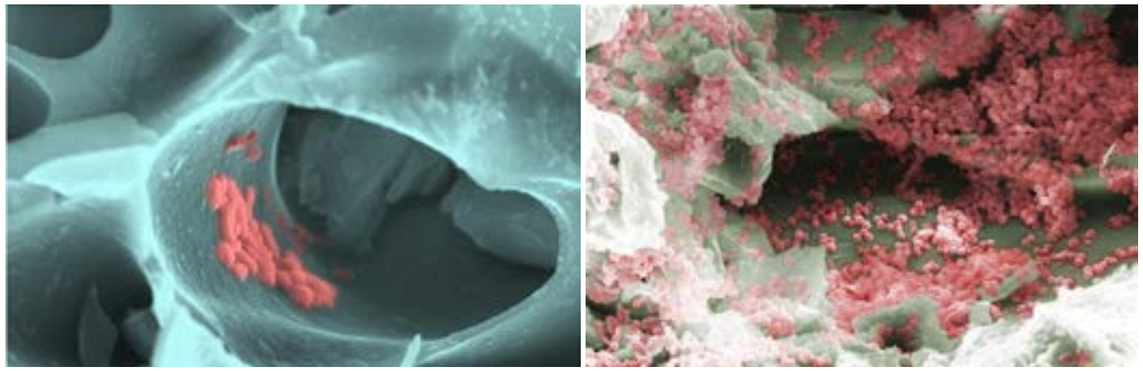
Mr. Edward Brial

Technology & Innovation Showcase

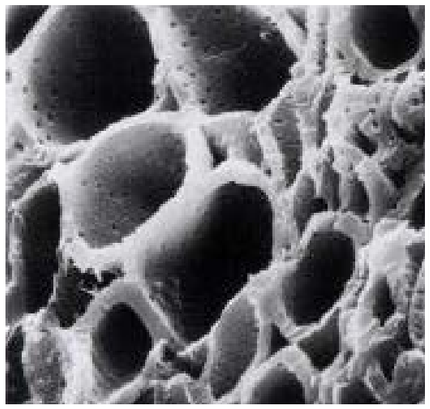
M/S Odour Services International Limited (Wolverhampton), UK

PRODUCTS
- LavaRok Bio-Filtration
- OdaCompact Biofiltration
- Rescue Packs
- ChemKlean wet scrubbing
- CuCarb dry media systems
- OdourShield CIF system
- Containerised Carbon units
- Standardised odour control units

SERVICES
- Expert Consultancy
- Flexible Funding
- Olfactometry Sampling and Analysis
- Training



Microbial colonisation of LavaRok® fissures



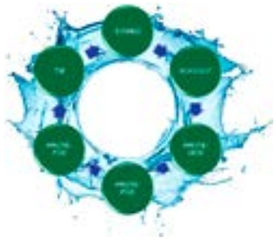
OSIL-Containerised CuCarb Units

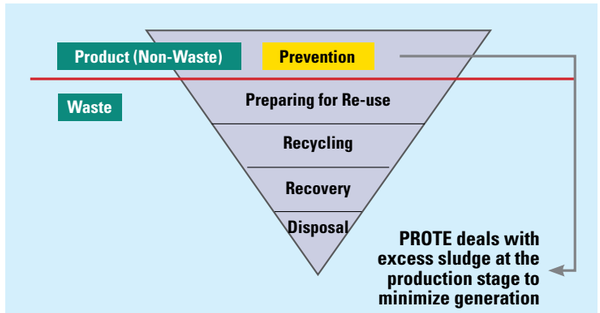
Mr. Matt Wilkes

Mr. Matt Wilkes (Executive Director) made a presentation entitled *Tailored Solutions for Your Odour & Air Pollution Problems through Proven Engineering & Innovation.* OSIL has developed products such as LavaRok® hybrid media biofilters (support materials for micro-organisms growth in the form of thin bio-film), CuCarb® activated carbon systems (a porous adsorbent with a highly developed surface area) and ChemKlean® wet scrubbing system. In addition, they also have "Rescue Pack" to effectively re-start microbiology of any given biological odour control system, and "Clean Start" system which effectively sterilize a media bed to allow for a re-inoculation or rescue pack product to be applied. The company has claimed to have reduced CAPEX and OPEX costs; containerised systems for hiring, leasing or outright purchase options; single technology to deal with multiple odour types. The technology is under operation at Western STP of Melbourne Water (Australia). The company aims to provide a consultative solution.

Technology & Innovation Showcase

M/S PROTE, Poland





PROTE

- Third decade in wastewater business
- 6x patented award-winning technologies dedicated for wastewater/ water companies
- 4x laureate of "TERAZ POLSKA" Award – under the patronage of the President of Poland
- 3x Polish Ministry of Environment / Ministry of Climate recognition as best Polish green technologies
- PROTE-fos recognized as one of 5 best projects funded by EU's Life+ Program
- Qualified NATO supplier
- HACH verification

Mr. Jerry Ślusarczyk

The presentation entitled "*Innovative Solutions in the Field of Closed-Loop Economy for the Natural Environment in India*" was made by Mr. Jerry Ślusarczyk (President, Supervisory Board). The company specializes in wastewater management technologies and offers services in the area of minimization of sludge (PROTE-MOS), process of sludge (PROTE-POS), lake reclamation technology and intensive bioremediation. PROTE-MOS significantly increases the sludge treatment efficiency with reduction of cost of operation by reducing reliance on chemical and tertiary costs on transportation. The company has also presented implementation results for Europe with average sludge reduction of approx. 30-73% and has shown considerable cost reduction by using PROTE-MOS. PROTE-POS aims 100% mineralization of sludge in acidic environment of sulphuric acid under exothermic reaction at about 130 °C. It can handle around 3000 tons of sewage sludge/ year/one module of the technological line. The technology appears to be proven and could be considered for pilot in India.

DAY 2:
Friday, December 11, 2020
14:00 – 16:00 hrs

CHAIR:
M Jawed [Professor, IIT Guwahati]

CO-CHAIR:
DP Mathuria [ED (Technical), NMCG]

MODERATOR:
Sundeep Singh Chauhan [Expert, cGanga]

CO-MODERATOR:
Daniel Scholten [Arkatap]

EXPERTS:
MM Ghangrekar [Professor, Indian Institute of Technology Kharagpur]
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BR Gurjar [Professor, Indian Institute of Technology Roorkee]
K Sri Harsha [Co-founder, Kritsnam Technologies]
M Mansoor Ahammed [Professor, SVNIT Surat]
S Shrihari [Professor, National Institute of Technology Karnataka Surathkal, Surathkal]
B Sikka [Senior Consultant, NMCG]
Vinay Kumar [Professor, Indian Institute of Technology Roorkee]
Ashish Mathur [Advisor, Grant Thornton]
Surya S Durbha [Professor, Indian Institute of Technology Bombay]
Pawan K Labhasetwar [Sr. Principal Scientist, NEERI Nagpur]

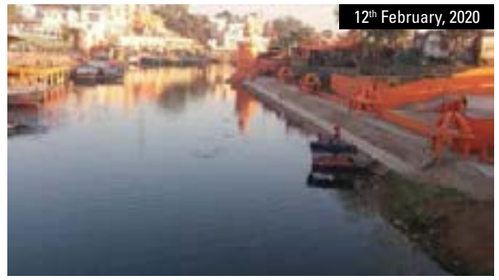
M/S Cownomics, India

Mowa Lake, Raipur

KEY CHALLENGES

- 70% surface had been acquired by the water weeds
- Regular sewage input causing rotten foul smell & decay of water
- Huge mosquito population breaking havoc of vector borne diseases
- Heavy water (high viscosity) almost still water
- Microbial infestation causing itch on skin when contacted with water

Mandakini River, Chitrakoot



KEY CHALLENGES

- Sewage inflow
- Turn water in to black opaque water
- High viscosity, felt like almost stagnated flow
- Major weed infestation

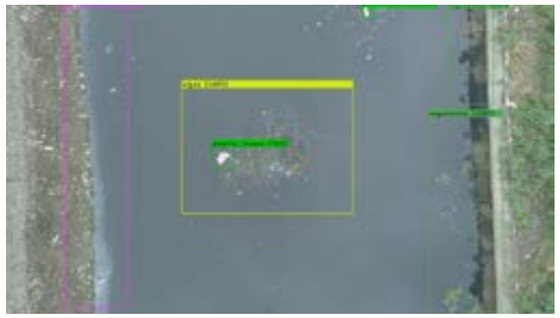
Mr. Madhukar Swayambhu (Head, R&D, Vedic Cownomics Pvt Ltd) made a presentation on "An Introduction to Cownomics – A Technology to Rejuvenate Water Ecologically". This technology is based on Vedic Science which considers water as a living ecology containing different microbes. These microbes help in decomposition of organics. The presentation highlighted success story for rejuvenation of water bodies in Rajnandgaon (Motipur Kaai Lake), Janjgir-naila (Darripaar Lake), Paatan (Buddhu Lake), Ranchi (Oxygen Park Pond), Ahmedabad (Edudi Lake), Delhi (Jheelwala Park), Raipur (Mowa Lake) and Chitrkoot (Mandakini River). These success stories are very interesting, however, there is a need to make long term studies to understand the treatment process and its sustainability vis-à-vis the overall status of the rejuvenated waterbodies. The claimed success of rejuvenation processes appears to be promising but it needs to be studied under technical supervision of an academic/ research institute before it is considered for ETV process.

Mr. Madhukar Swayambhu

Technology & Innovation Showcase

M/S Takeleap, UAE

Sewage opening into the river



Coum River, Chennai

WHAT?

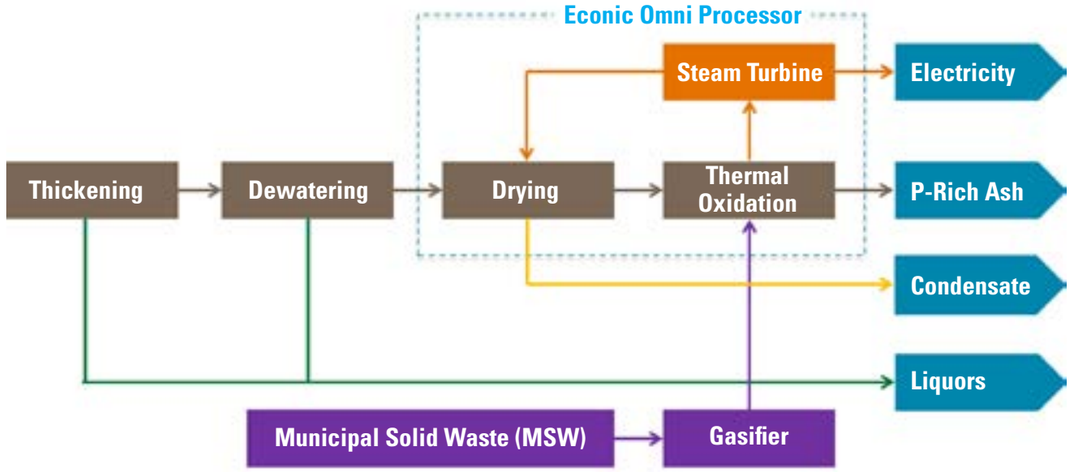
Computer vision based analysis of the footage of the river to identify and classify the waste that floats on the river for civic authorities to act upon.

Chemical waste and uncontrolled algae growth

Mr. Dhamodaran

M/S Takeleap uses computer vision based analysis of footage of river to identify and classify floating wastes. The footages are obtained through static camera monitoring, drone camera monitoring flying at a lower altitude, thermal cameras and light detection and ranging (LIDAR) surveying. The methodology used is to divide the entire length of the river into multiple grids and sub-grids, correlate grids/sub-grids to municipalities, record entire length of the grid using drone cameras to detect wastes and illegal dumping into the river, analyse video footage using trained models, map the analyse data with latitude and longitude which may help municipal authorities to detect illegal waste dumping points for effective control. Mr. Dhamodaran (GM India) made the presentation and has shown a case study of Coum River in Chennai. To a pointed query from the panel, they are yet to develop expertize in measurement of river water quality using camera in addition to visible floating objects on the river surface. It applies Industrial 4.0 fundamentals. However, it has to be further developed for application in our context under mentorship of an academic/research institute before it can be considered for ETV process.

M/S Xylem India, USA



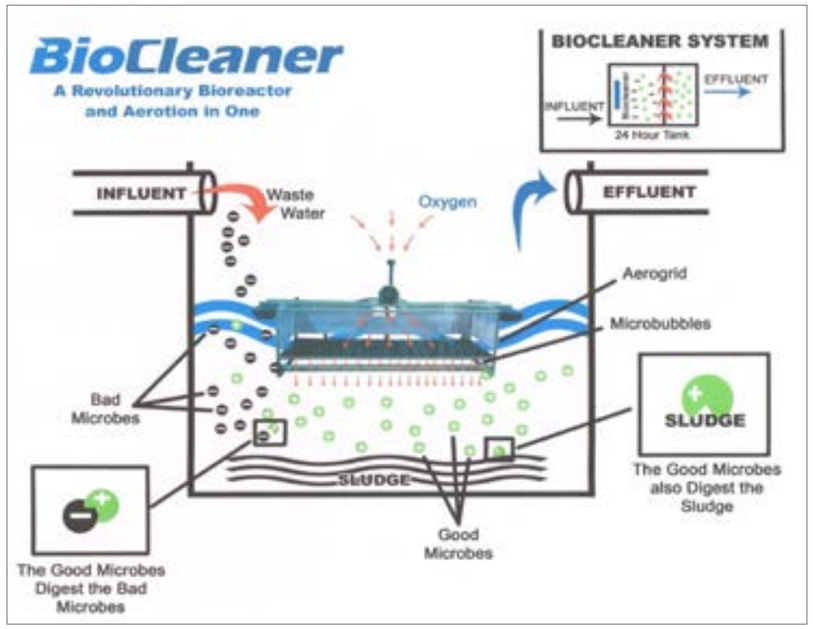
Process description

Mr. Satnam Singh

Mr. Satnam Singh (GM India) highlighted Xylem's technology – "*Econic Omni Processor Sludge Treatment Technology*". Sewage and industrial wastewater treatment plants generate a large quantity of sludge after primary and secondary treatment. Xylem's technology is a thermal oxidation based process for sludge treatment. The technology offers the handling including drying and complete disposal of sludge in the same system with net neutrality in water and energy consumption. The system converts the sludge into pathogen-free non-hazardous ash by reducing its weight up to 90% and in doing so generates the system power for self-sustainment and distilled water is also recovered as value added product. Mr. Singh also presented brief details of pilot installed at Vadodara which has been commissioned recently. Since the pilot is already operational in India, let the company present the data generated so far while considering this technology for ETV.

Technology & Innovation Showcase

M/S Biocleaner, USA



HOW DOES IT FUNCTION?

- Air injected to Biotube and aeration grid
- Microbes are released
- Air bubbles force microbes to surface by gravity
- Laminar flow spreads microbes in tank and hydraulic head pushed microbes down in layers
- Biobed forms

Mr. Dennis Tee

Mr. Dennis Tee (VP Asia) presented BioCleaner's breakthrough technology which is claimed to treat all kinds of organic waste coming out of residential, commercial, industrial and municipal sectors. BioCleaner constantly produces its own good microbes, eliminating the need to add new microbes on daily basis. The microbes are all-natural and have not been genetically modified. In this system, air is injected to biotube within an aeration grid where microbes are released. Air bubbles force microbes to surface while laminar flow spreads microbes in tank and hydraulic head pushes microbes down in layers leading to formation of biobed. Though the technology appears to be new, but the company has not presented any data from pilot or field studies showing the success or limitation of the technology. Hence there is a need to check the efficacy and viability before it is considered for ETV process.

So why BioCleaner?

It is modular and portable. Maintenance is easy

On Site Creek and Pond Treatment

Foshan River before treatment

Foshan River after treatment

Technology & Innovation Showcase

DAY 3:
Saturday; December 12, 2020
14:00 – 16:00 hrs

CHAIR:
M Jawed [Professor, IIT Guwahati]

CO-CHAIR:
D P Mathuria [ED (Technical), NMCG]

MODERATOR:
Sundeep Singh Chauhan [Expert, cGanga]

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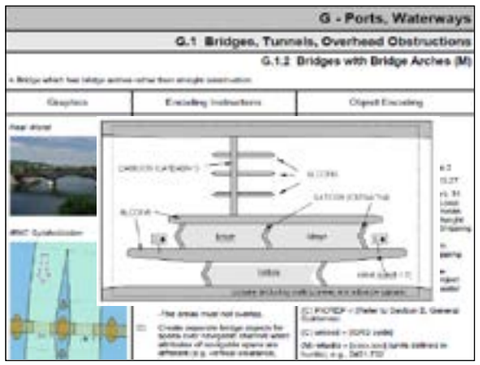
S Shrihari [Professor, National Institute of Technology Karnataka Surathkal, Surathkal]
B Sikka [Senior Consultant, NMCG]
Vinay Kumar [Professor, Indian Institute of Technology Roorkee]
Ashish Mathur [Advisor, Grant Thornton]
Surya S Durbha [Professor, Indian Institute of Technology Bombay]
Pawan K Labhasetwar [Sr. Principal Scientist, NEERI Nagpur]

M/S General Directorate of Water Management, Hungary

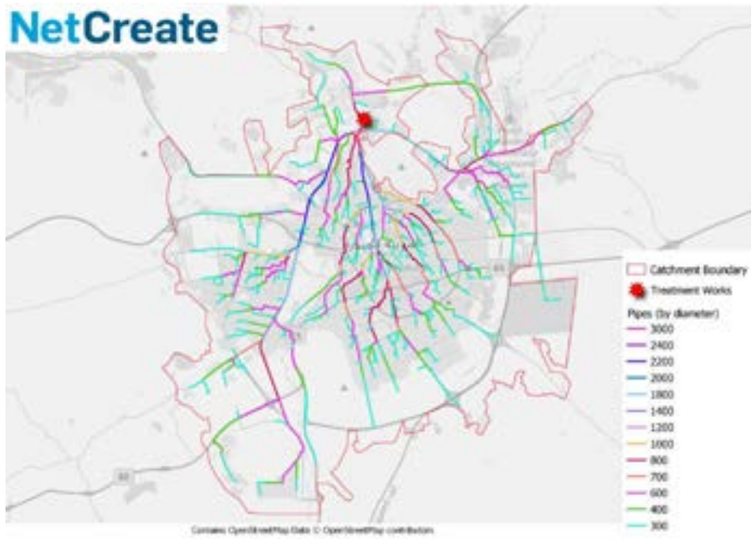
Inland waterway is regulated by regional or/and national regulation (EU: Several countries)



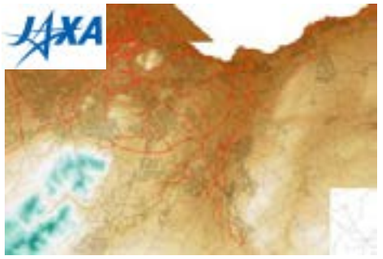
iENC charts are similar to 'maritime' ENCs, with a few exceptions

A presentation was made on "*River Information System (RIS)*" by Mr. Bede Csaba. The RIS mainly deals with transport and logistics as well as traffic and safety. In Hungary, lower parts of big inland waterways are used by both inland and maritime vessels whereas smaller navigable rivers have specific features such as groins, groundsills and revetments and therefore specific regulation with specific signals, markings and traffic rules are mandated. For this purpose, there is a need to have RIS which helps in meeting the changing requirements for inland waterways such as ice condition, water level and bridge clearance information, shallow and narrow section information etc. depending on seasonal changes. Advanced technology applications have promise in India and may be piloted in an Indian river during ETV process.

M/S Atkins, UK



NetCreate conceptual sewer layout Medina City, population 1.5M



Digital terrain model


Population data

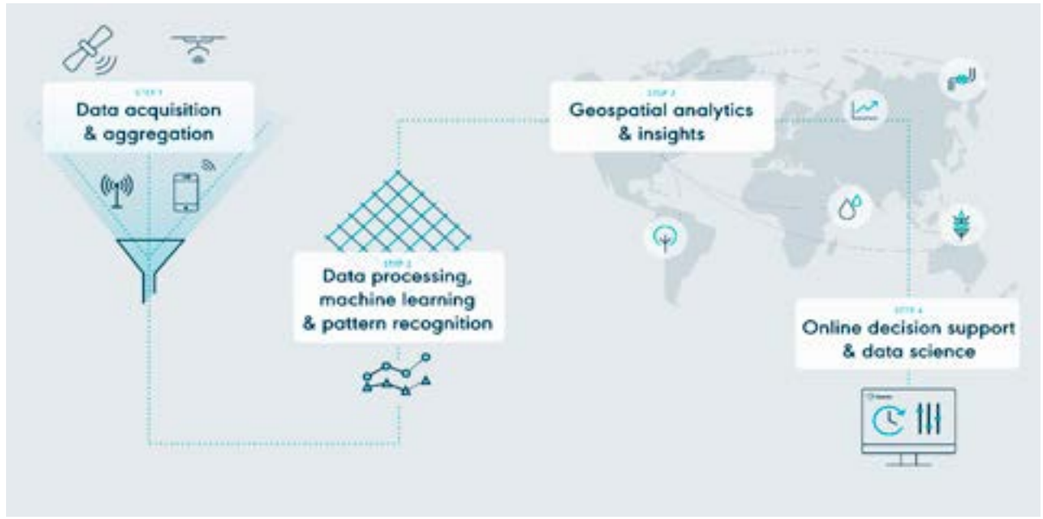
Mr. Matt McDonald (Lead) introduced *NetCreate* for planning of wastewater networks for clean Ganga. The planning and design of wastewater networks requires extensive data collection and is generally considered a time-consuming activity. NetCreate appears to be an innovative digital process that uses global open source GIS datasets to automatically create an outline wastewater network. It brings together topographic data, road layout data and population distribution data to assign the route of least resistance from each property to the lowest point in the catchment along defined roads. Pipe sizes are assigned based on the number of customers; manholes are inserted at junctions and defined intervals on straight pipes; cover levels are taken from topographic data; gradients and pipe depths are based on good engineering practice. NetCreate has been tested for wastewater Master Planning project in Saudi Arabia by generating outline wastewater network layouts and schedules of quantities for 150 catchments. The company has claimed to use NetCreate for planning wastewater network layouts for a 600,000 population catchment in Lucknow (India) and a 160,000 population hilly catchment in Kenya. It appears that NetCreate gives a satisfactory solution for a new sewer network. However, the ability of


Mr. Matt McDonald

NetCreate for augmenting the sewer network of an existing city has not been dealt with in the presentation. This aspect may be highlighted with the company representative while considering their case for ETV process.

Technology & Innovation Showcase

M/S BV–Rezatec, UK



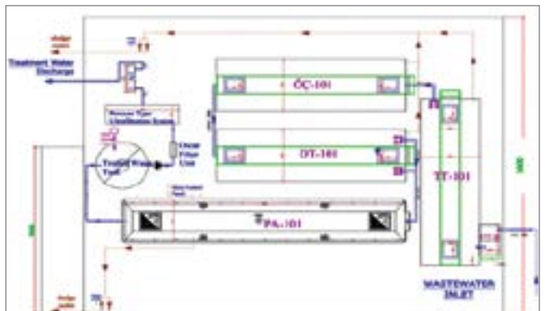
The power of Satellite Data Analytics: Emergence of Satellite Ground Movement Detection

Ms. Rachel Pether

Mr. Martin Guthrie

Ms. Rachel Pether (Director, Water Utilities) and Mr. Martin Guthrie (Senior Partner Manager) made a presentation on *"Satellite Data Analytics: A New Tool in Risk Management for Reservoir Safety"*. It combines satellite-derived earth observation data with advanced geospatial analytics to provide a dam and embankment monitoring solution. The services being offered by them includes remote sensing analysis, machine learning and geotechnical expertise to provide an intelligent decision support tool. This can be used to prioritise future investment and enable early intervention to maximise economic benefits and prevent dam and embankment failures. The presentation highlighted a case study of dam monitoring works which included (i) building a full risk profile using historic and current data, (ii) monitoring trends in dam movement, (iii) monitoring surrounding environment and (iv) deploying resources to the right place at the right time. It is much more suited for water resources management and therefore, may not be taken up right now for ETV proves.

M/S Felső-Bácska Storage Windpart Co. Ltd., Hungary



MWWTP - Mobile waste water treatment plant

Removing Microplastics- Ultrafiltration System

Benefits:

- Low operating costs
- Low investment costs
- Minimal operating problems
- Portability and easy installation
- Mobile and modular
- Requires minimal local infrastructure
- Designed according to the active sludge system

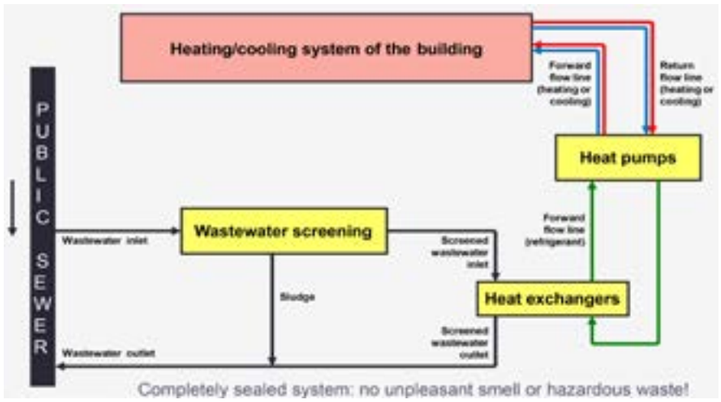
Mr. József Kovács (Waste Management Specialist and Head, Sustainability & Waste Department) made a presentation on *"Technological Approaches for the Reduction of Microplastic Pollution in Waste Water with applied Mobile Technology – MWWTP"*. It has been claimed that the MWWTP is an emerging technology for the reuse of grey water without micro-plastics. This technology is based on reverse osmosis (RO). The RO system removes sediment and chlorine from water with a pre-filter before it forces water through a semi-permeable membrane to remove dissolved solids. The MWWTP RO systems have various stages depending on their number of pre-filters and post-filters per as the local requirements. However, the presentation has not provided any information on backwashing of the membrane and how the concentrated micro-plastics are handled for final disposal. The shortcoming may be highlighted during the course of consideration for ETV and depending upon the feedback received, a final call may be taken for ETV process.

Technology & Innovation Showcase

M/S Thermowatt Ltd., Hungary

Mr. Pál Kiss

A presentation was made by Mr. Pál Kiss (CEO) on "*Wastewater-Heat Recovery to Cool (/Heat) Buildings"* which has been claimed as CO^2 mitigating and climate adapting technology. The Company has developed a technological solution to harness and utilize energy from city's sewage to cool large buildings in a modern, environmentally friendly and economical way. The "Method and Circuit Arrangement for Recovering Heat from Wastewater" is under granted patent protection in 37 countries. The main point of the Thermowatt Technology is to take out wastewater from the sewer line, direct it to a heat exchanger in a mechanically filtered form and then lead it back to the sewer line along with the separated solid particles. The Company has successfully installed this technology in Hungary at MOM Cultural Centre (8600 m^2, 1 MW), Offices and Warehouse of Budapest Sewage Works Premises (9000 m^2, 1 MW), MH EK Military Hospital (40000 m^2, 3.8 MW), University of Szeged (25000 m^2, 1.4 MW). In addition, they are also project in progress in Romania, Paris and Canada. This technology may have application in some of the states which faces extreme cold weather and therefore, may be considered for ETV process.



The Thermowatt Technology – Process Flow Diagram

MOM CULTURAL CENTER – PROJECT TECHNICAL DATA

• Flow of Wastewater:	90 m^3/h
• Average temperature of wastewater:	15-17˚C
• Temperature of return wastewater (heating):	10˚C
• Temperature of return wastewater (cooling):	25˚C
• Heat Pump capacity in heating mode:	645.8+569= 1214.8 kW
• Heat Pump capacity in cooling mode:	567.4+505= 1072.4 kW
• COP:	6.78-8.24
• Δ T (heating) :	35/20˚C
• Δ T (cooling) :	6/16˚C
• Flow of water (heating):	25+25 m^3/h
• Flow of water (cooling):	25+13 m^3/h
• Power demand (above the demand of heat pump):	43 kW

COMPLETION OF THE IMPLEMENTATION OF MOM CULTURAL CENTRE, Hungary

System is in Operation and Under Monitoring Since April 2011

Technology & Innovation Showcase

DAY 5:
Monday, December 14, 2020
14:00 – 16:00 hrs

CHAIR:
M Jawed [Professor, IIT Guwahati]

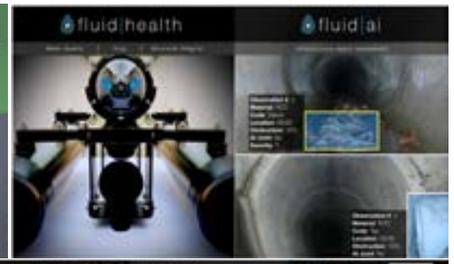
CO-CHAIR:
DP Mathuria [ED (Technical), NMCG]

MODERATOR:
Sundeep Singh Chauhan [Expert, cGanga]

CO-MODERATOR:
Daniel Scholten [Arkatap]

EXPERTS:
MM Ghangrekar [Professor, Indian Institute of Technology Kharagpur]
Absar Ahmad Kazmi [Professor, Indian Institute of Technology Roorkee]
BR Gurjar [Professor, Indian Institute of Technology Roorkee]
K Sri Harsha [Co-founder, Kritsnam Technologies]
M Mansoor Ahammed [Professor, SVNIT Surat]
S Shrihari [Professor, National Institute of Technology Karnataka Surathkal, Surathkal]
B Sikka [Senior Consultant, NMCG]
Vinay Kumar [Professor, Indian Institute of Technology Roorkee]
Ashish Mathur [Advisor, Grant Thornton]
Surya S Durbha [Professor, Indian Institute of Technology Bombay]
Pawan K Labhasetwar [Sr. Principal Scientist, NEERI Nagpur]

M/S Fluid Robotic – Black & Veatch, India



Mr. Rajesh Patwardhan (Head, India) made the presentation entitled "Accelerating the End of Pandemics" and highlighted application of fluid robotics in assessment of sewer conditions through video recordings. Fluid Robotics uses artificial intelligence and machine learning algorithms to arrive at the better solutions for sewer condition assessment and the system is called as Fluid AI. As an extension to this application, they used it to collect sewage samples from sewers in a catchment area of Bangalore, testing for Sars-Cov-2 Virus (in a designated laboratory) and then based on AI/ML algorithms developed maps to indicate potential active cases as a lead indicator to help utilities get prepared with a possible increase in cases or otherwise. They call this solution Fluid Health. However, the major bottleneck is the testing time for the sample and therefore panel wanted to know the possibility of reducing this time period from collection of the sample to getting the test results, otherwise the whole exercise may not serve the intended purpose with the ongoing pandemic. The technology related with health assessment of sewer lines may be required and therefore, this part may be piloted in our country.

Mr. Rajesh Patwardhan

M/S Indian Rubber Manufacturers Research Association (IRMRA), India

Longer Rubber Dam in Korea

Project	Daegu Rubber dam in Korea		
Type	Length x Span	Height	Time
Bookend	72m x 2	3m	2007

One of the rubber dam installed at BBR, Orissa site for studies and evaluation

ADVANTAGES OF RUBBER DAM

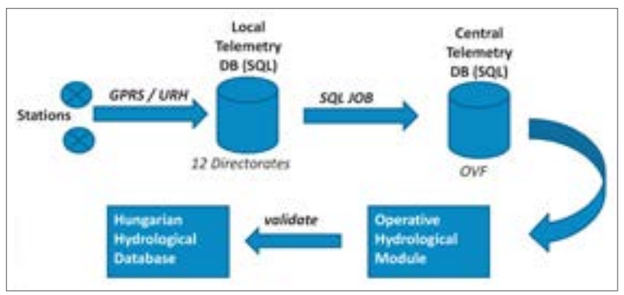
- Better water conservation, soil erosion and flood control during flood
- Simple and inexpensive operating system
- Perfect sealing; no leakage
- Virtually maintenance free; no moving parts, no painting
- Multiple spans of several hundred meters possible
- Light structure
- Clean operation; no hydraulic oil required
- Can always be "opened" (deflated); no possibility of jamming
- Installation cost marginally lesser than conventional dam

Dr. Rajkumar Kasilingam (Director) made a presentation entitled "Role of Flexible Rubber Dam in Water Storage Management". The presentation included application of air-inflatable and deflatable rubber dam of 35 m long, 1 m span and 2 m height (in China); 39 m long, 1 m span and 5 m height as well as 72 m long, 2 m span and 3 m height (in Korea). They have also implemented this to smaller check dams in Maharashtra, Orissa and Gujarat and to a bigger dam at Nagpur. The presentation also indicated some maintenance issues with rubber dams such as rubber body could be damaged by vandalism, sharp objects from flooding could impact the rubber body, and there is a requirement to keep the rubber slightly inflated under wet conditions. Dr. Rajkumar has already received recognition from the state of Goa and Madhya Pradesh for his contribution to rubber dam projects. The rubber dam technology may be tested in rejuvenation of drains in urban areas where treated sewage may be stored before allowing it to pass downstream water sources. This technology may be considered for ETV process.

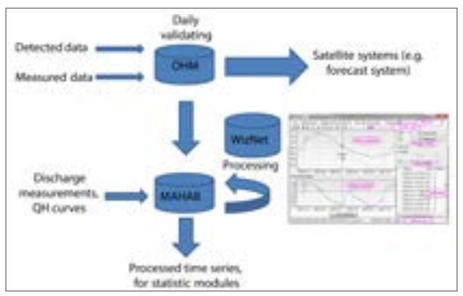
Dr. Rajkumar Kasilingam

Technology & Innovation Showcase

M/S General Directorate of Water Management, Hungary

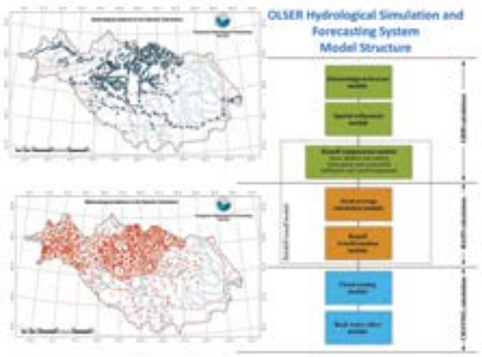


Functional diagram of the telemetry system (database (DB) connections)



Processing procedure

Mr. András Csik (Head, Hydrological Monitoring & River Basin Management Department) made the presentation entitled "Digital Water – Data and Information Management". The operation of surface water monitoring network consists of 8000 stations and hydrological work is carried out by 150 full time employees with support from several part-time fellows and external co-workers. Around 1000 online hydrological monitoring stations collect data with the aid of digital sensors and the collected digital data is communicated through telemetry system to central telemetry database. The collected data is being fed to operative hydrological module to generate useful information on water management. This monitoring system has been shown to be functioning satisfactorily in Hungary. However, the

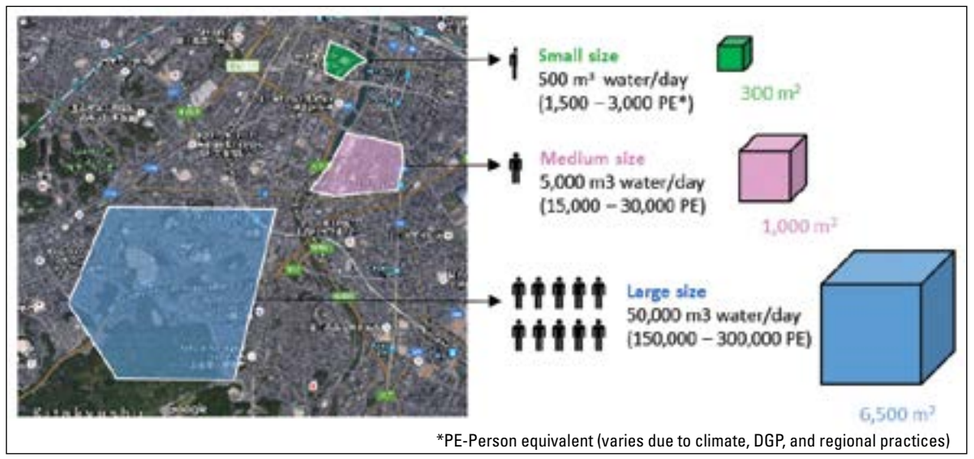


digital sensor has a definite life and it requires regular maintenance by technical personnel during the service period thereby putting additional costs. This kind of systems shall be required in future and therefore, a call may be taken while considering their request for ETV process.

M/S WaterScope Inc., Hungary

SCALES FOR WATER INFRASTRUCTURE

A look at three possible scales for water infrastructure including treatment, re-use and material recovery



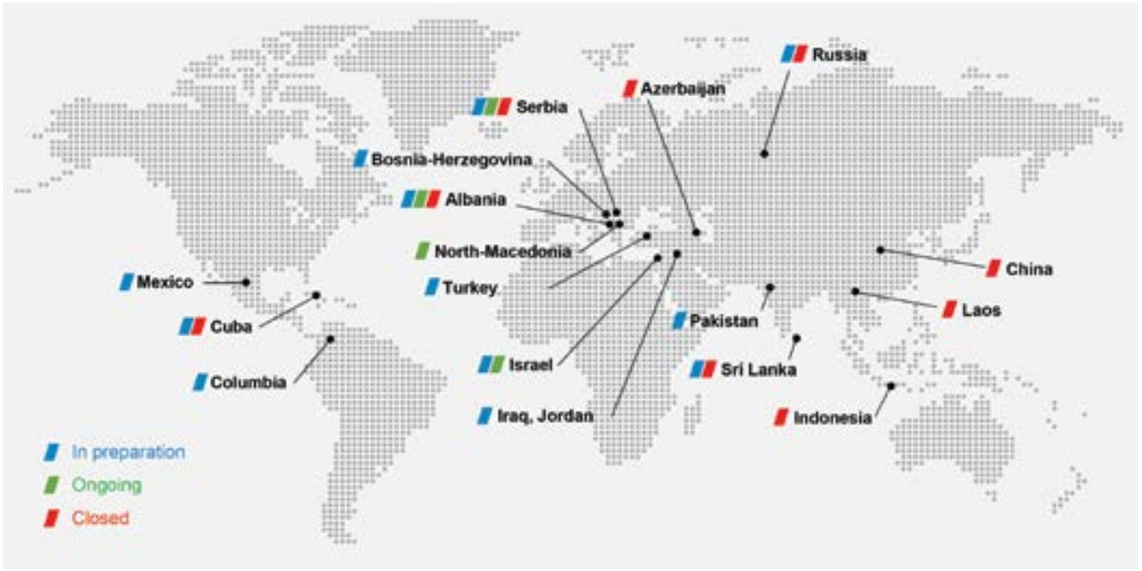
*PE-Person equivalent (varies due to climate, DGP, and regional practices)

Footprint sizes are approximate and vary according to design

The presentation by Mr. Frank Marton (Director) was focussed on "Water Strategies 4.0 Smart Cities". The presentation highlighted scales for water infrastructure such as small size with water requirement of 500 m^3/d for population equivalent of 1500-3000, medium size with 5000 m^3/d for population equivalent of 15000-30000 and large size with 50000 $^3/d$ for population equivalent of 150000-300000. It also showed possibility of variability in shape and form of water infrastructures depending upon space constraints in the city system, recovery of re-usable end products with primary focus on water recycling and then advocating for systematic un-slumming with modular resource hubs. The entire innovations are based on AI based predictive maintenance of water bodies and facilities, cable free sensor systems for water treatment, reuse and resource recovery plus an AI based laser measurement system for algae based biofuels and food production. However, the sensor needs frequent cleaning and maintenance otherwise impacting the entire operation. Hence, the issue of sensors may be raised with the representatives of the company while considering their request for ETV process.

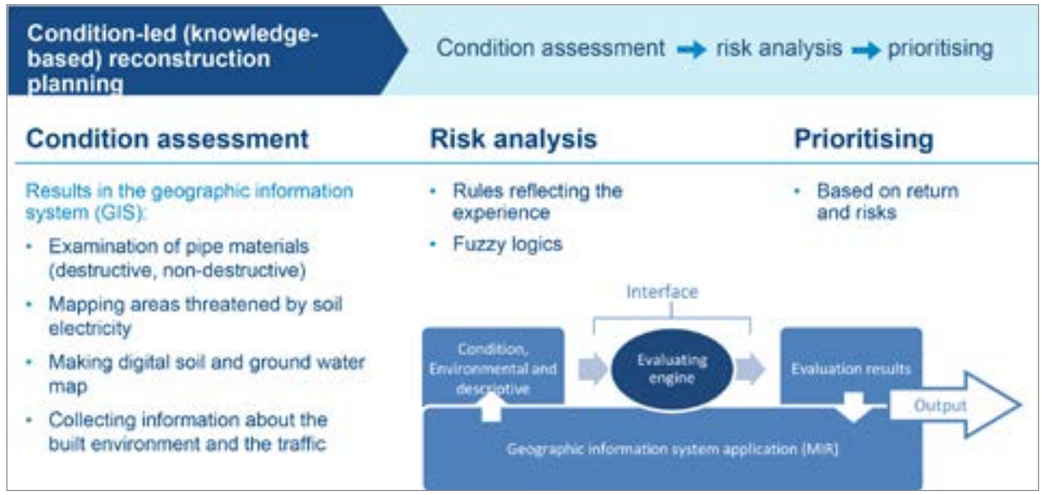
Technology & Innovation Showcase

M/S Budapest Waterworks, Hungary

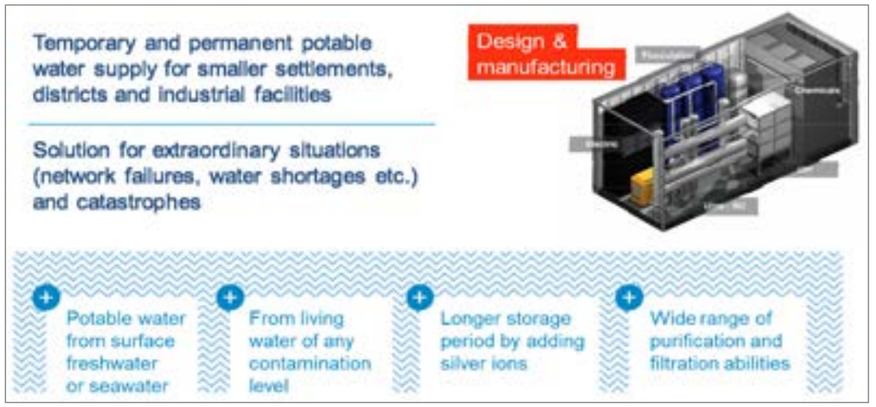


Completed and ongoing projects worldwide

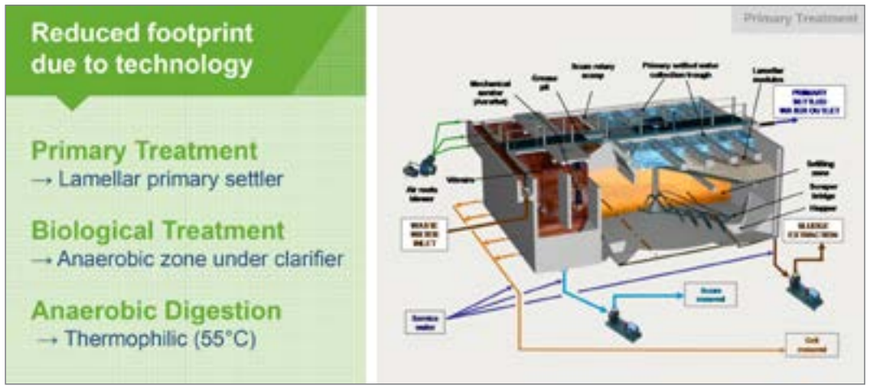
M/S Budapest Waterworks is a water utility operator company. The company has over 150+ years of operational experience in maintaining 7177 km long water supply network with 1 million m^3 daily capacity water production from 2 water treatment plants as well as 828 km long sewer network with 7 wastewater treatment plants having treatment capacity of 370000 m^3 daily. The presentation by Ms Rita Studniczki [in place of Mr. Tamás Bencze (International Business Development Director)] gave an overview on Digital and Environment-friendly Solutions. The company has developed and integrated several digital and environmentally-friendly solutions to make the operations more efficient and to reduce environmental footprint. This is being carried out using digitization such as robotic process automation, paperless maintenance and repair management, digital customer service for convenience and efficiency. There is a need to demonstrate all these applications in one of Indian metro cities to begin with. This may be considered for ETV process in a part of a major metro city.



Network reconstruction planning



Mobile water purification systems



Budapest Central Wastewater Treatment Plant

Technology & Innovation Showcase

DAY 6:
Tuesday, December 15, 2020
14:00 – 16:00 hrs

CHAIR:
M Jawed [Professor, IIT Guwahati]

CO-CHAIR:
DP Mathuria [ED (Technical), NMCG]

MODERATOR:
Sundeep Singh Chauhan [Expert, cGanga]

CO-MODERATOR:
Daniel Scholten [Arkatap]

EXPERTS:
MM Ghangrekar [Professor, Indian Institute of Technology Kharagpur]
Absar Ahmad Kazmi [Professor, Indian Institute of Technology Roorkee]
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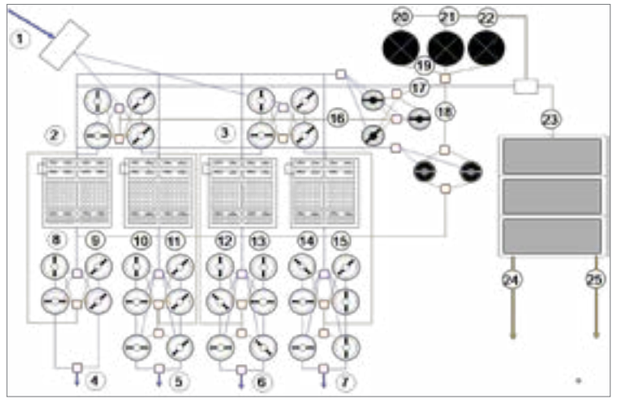
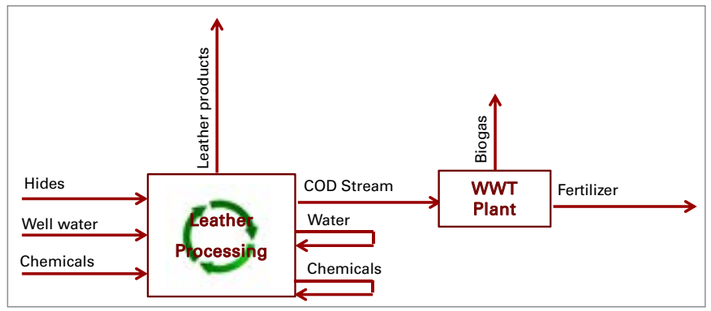
S Shrihari [Professor, National Institute of Technology Karnataka Surathkal, Surathkal]
B Sikka [Senior Consultant, NMCG]
Vinay Kumar [Professor, Indian Institute of Technology Roorkee]
Ashish Mathur [Advisor, Grant Thornton]
Surya S Durbha [Professor, Indian Institute of Technology Bombay]
Pawan K Labhasetwar [Sr. Principal Scientist, NEERI Nagpur]

M/S Bioscavenge, Denmark



CAPE FLATS FLOW DIAGRAM

1 – influent wastewater (INF)
2,3 – primary overflow (PRIMov)
4,5,6,7 – effluent (EFF)
8,9,10,11,12,13,14,15 – reactor outlet (REAC)
16 – primary underflow (PRIMun)
17 – thickener underflow (TKNun)
18 – flotation overflow (FLOTov)
19 – Anaerobic digester inlet (ADin)
20,21,22 –
Anaerobic digester outlet (Adout)



Implementation of Circular Economy – Greentan project (Innovation Fund Denmark)

Prof. Krist V Gernaey

Prof. Krist V Gernaey (Department of Chemical and Biochemical Engineering, DTU and CEO) represented the company and made a presentation on "Resource Recovery Alternatives in South African Water Treatment (ERASE)". The presentation was focussed on sludge management strategies from residential flats in the city of Cape Town. The strategies applied were (a) anaerobic digestion with energy recovery, (b) thermal hydrolysis pre-treatment with energy recovery, (c) thermal hydrolysis pretreatment + partial nitration/anammox and (d) thermal hydrolysis pretreatment + struvite precipitation and harvesting with phosphorus recovery. In addition, resource recovery strategies have also been shown from production process and implementation of circular economy for leather processing unit. Resource recovery is a new dimension and should be explored in India diligently. A potential candidate for ETV process.

M/S DHI, Denmark

WEST

- Dynamic simulator of physico-bio-chemical processes
- Main traditional application: Wastewater Treatment Plants (**WWTP**)
- Novel applications:
  - Transition to Water Resource Recovery Facility (**WRRF**)
  - Integrated Urban Water Systems (**IUWS**): sewer, **WWTP**, recipients
- Potentially extendable to any other water quality domain
- Overall, *generic modelling and virtual experimentation platform for water quality*

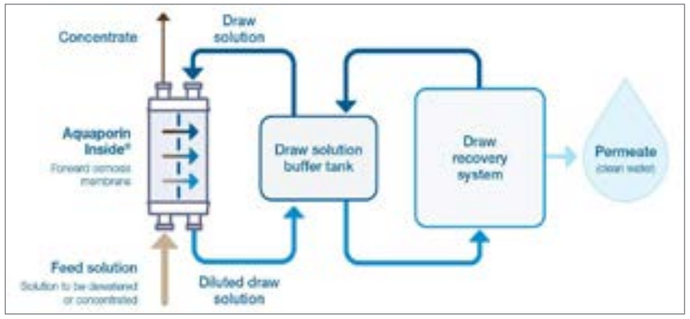
Mr. Sajid Ali made the presentation. His presentation was mainly focussed on application of MIKE softwares – which are generally used in simulation and modelling in the area of water resources engineering research works around the world including India. The presentation also included few slides on how to use the software. In addition, the company is also in the process of developing exclusive softwares for the dynamic modelling and simulation of wastewater treatment plants, sewer network etc. However, these softwares are yet to be used for actual design of treatment plants or sewer networks design anywhere in India. Mr. Manish Kumar of the company was also in attendance during the presentation. It is not required to consider for ETV process as these softwares are already being used for Water Resources Management purposes and it has very little for water/wastewater treatment and management.

Technology & Innovation Showcase

M/S Aquaporin, Denmark

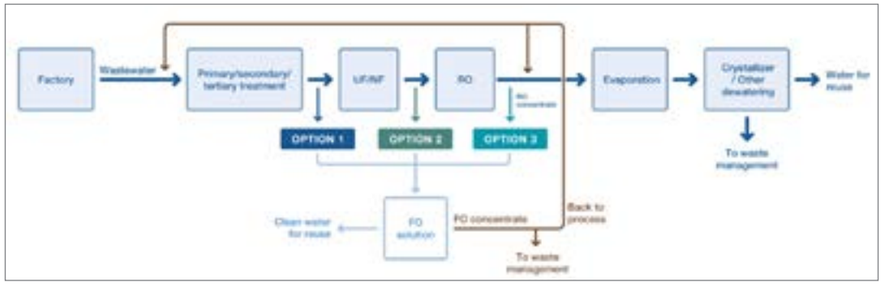
FORWARD OSMOSIS (FO) USES NATURAL ENERGY TO TRANSPORT WATER

- FO uses natural, osmotic pressure to transport only water through a membrane
- The concentrated "draw solution" drives the FO process
- Regeneration of the draw solution is often needed to maintain the driving force and to extract clean water as a product



THE BENEFITS OF APPLYING FORWARD OSMOSIS IN CONVENTIONAL EFFLUENT TREATMENT PLANTS

Effluent treatment plant (ETP) with discharge to river/water bodies



Primary, secondary and/or tertiary treatment can be fully or partly replaced by an FO system (option 1-3). Alternatively, an FO system can be added as an additional treatment to further reduce effluent volume (option 4). The choice of solution depends on the effluent feed composition, technologies in place and desired outcome.

Some of the benefits of applying FO in conventional ETPs include:

- Simplified effluent treatment processes
- Less sludge generation / handling
- Optimized use of land when designing new or expanding existing ETPs
- Enables reuse of high-quality water in wet processing (dyeing, washing) or utilities (boiler feed, cooling tower, etc.)

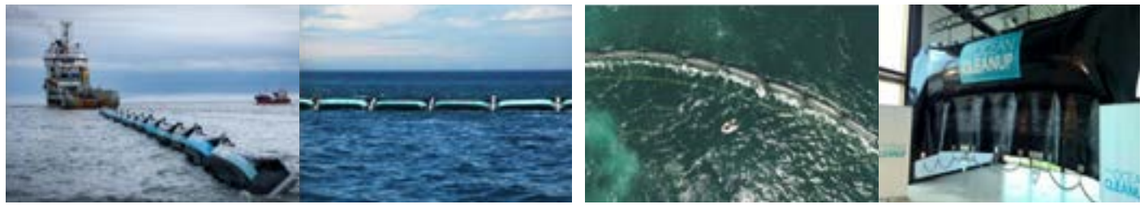
Mr. Adarsh Raj

Mr. Adarsh Raj, Account Manager (Industrial Water) made the presentation on their process "Aquaporin: Water Made By Nature, Forward Osmosis Solution" for the production of clean water. The presentation demonstrated use of forward osmosis as an additional treatment unit for obtaining minimal or zero liquid discharge from effluent treatment plant, but with lower overall costs due to OPEX savings on subsequent evaporation unit. The process has successfully been used for the treatment of textile wastewaters and greywater treatment in space station. However, the safe disposal of retentate is still an issue. To a pointed question from the panel, it was informed that the membrane is manufactured in USA as it has market there. As of now, they do not have any plan to put up membrane manufacturing unit in India. However, they have shown their willingness for going through ETV process. FO is a promising technology but without membrane manufacturing indigenously, it may not be economically viable. However, it is still a potential candidate for ETV process.

M/S DESMI, Denmark

BUSINESS SEGMENT: KNOWLEDGE, EXPERTISE & OPERATIONS

- Known as World Leader in Combating Oil Spills
- World's most experienced Oil Spill Response and Marine Pollution Control equipment manufacturer
- Known for expertise in containment and collection equipment in oceans, seas, rivers & lakes to deflect and collect surface oil, marine debris & seaweed
- Green technologies and environmental conscious products & systems that comply with global regulations
- Production facility in China, Denmark, India and the US



DESMI's first "Ocean Clean-Up" in North Sea in 2016

The Company has indicated expertize in five major segments – Marine & Offshore (mainly supplying marine pumps to container ships and fishing vessels), Industry (involved in assessment of reliability, productivity and performance of production plants), EnviRo-Clean (provides solutions for oil spill, seaweed & marine debris), Defence & Fuel (involved in fuel handling for armed forces around the world), and Utility (supplying energy efficient & reliable pump solutions). Under EnviRo-Clean segment, the company has extended services in containment and collection equipment in oceans, seas, rivers & lakes to deflect and collect surface oil, marine debris & seaweed. The Company has indicated its presence in India by taking up cleaning projects at some of the locations around Delhi. In addition, they have also indicated availability of waste management using incinerator. The Company is keen to go through ETV process. The presentation was made by Ms. Neha Mehta (SVP, Desmi EnviRo-Care) and Cdr. Tarun Saxena, Head of EnviRo-Care India was also present during the presentation. A final call for consideration for ETV process be taken by the committee likely to be constituted for the same.

Ms. Neha Mehta

Cdr. Tarun Saxena

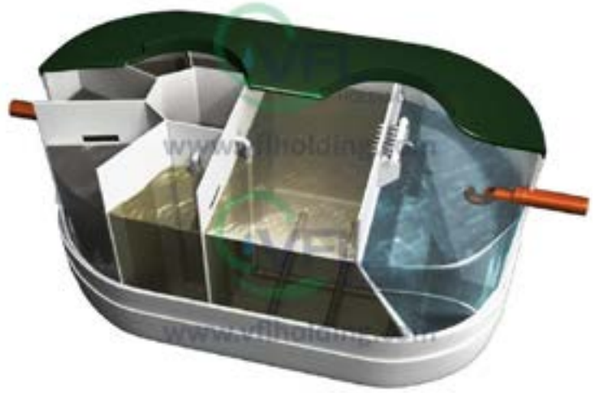
Technology & Innovation Showcase

M/S SENEX Environmental Consultancy Ltd, Hungary

Technological Scheme

1. Inflow
2. Basket screen
3. Internal recirculation-air-lift pump
4. Anaerobic and anoxic zones with "Vertical Flow Labyrinth"
5. Oxic chamber
6. Fine-bubble diffusor
7. Final clarification chamber
8. Recirculation of sludge-air-lift pupm
9. Air blower
10. Power 230 V, 50 Hz
11. Control unit AQC Plus (GSM)
12. Integrated retention chamber
13. Outflow
14. Air-lift pump for mixing the content of the basket screen

Effluent Quality – Biological Treatment



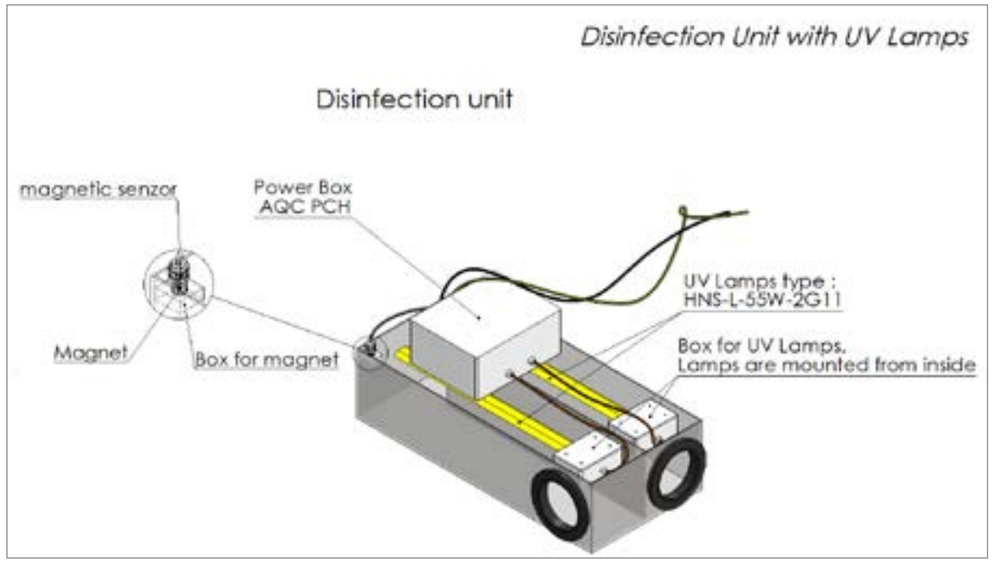
Parameter	Commonly achieved values	Guaranteed values
COD_{Cr}	35 mg/l	70 mg/l
BOD_5	10 mg/l	15 mg/l
SS	10 mg/l	20 mg/l
$N\text{-}NH_4$	2 mg/l	5 mg/l
N_{tot}	15 mg/l	25 mg/l
P_{tot}	3 mg/l	7 mg/l

Mr. Gábor Perényi

A presentation on "Decentralized Wastewater Treatment Solutions" was made by Mr. Gábor Perényi (Managing Director). The Firm has claimed to have 70000 installations of wastewater treatment plants with VFL technology in 50 countries. The VFL wastewater treatment plants have been claimed to treat communal wastewater from a wide range – from family houses to whole residential areas. The treatment process used in VFL technology is a continuous-flow activated sludge process with biological nitrogen and phosphorus removal and all the processes are claimed to be carried out in a single tank. The Firm has fabricated decentralized wastewater treatment plants to handle a flow rate of up to 135 m^3/d. The presentation also contained a technological scheme of the tertiary treatment unit. However, the Firm has not indicated to install any treatment systems in India so far and probably looking forward for an opportunity.

Decentralized WWTPs up to 135 m^3/day (900 PE)

- Compact, oval shaped wastewater treatment plants
- Transport with a standard sea container
- Quick and easy installation ("plug and play")
- Modular and expandable (by installing several units in parallel)



Effluent Parameters – Tertiary Treatment Unit

Parameter	Effluent
COD_{Cr}	30 mg/l
BOD_5	2.0 mg/l
SS	4.0 mg/l
E.coli	3 CFU/100 ml
Total coliforms	1 CFU/100 ml
Enterococci	2 CFU/100 ml

Technology & Innovation Showcase

DAY 5:
Monday, December 14, 2020
19:00 – 21:00 hrs

CHAIR:
M Jawed [Professor, IIT Guwahati]

CO-CHAIR:
DP Mathuria [ED (Technical), NMCG]

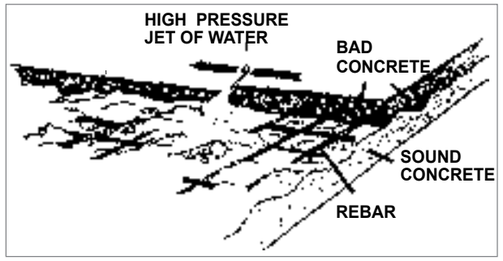
MODERATOR:
Sundeep Singh Chauhan [Expert, cGanga]

CO-MODERATOR:
Daniel Scholten [Arkatap]

EXPERTS:
MM Ghangrekar [Professor, Indian Institute of Technology Kharagpur]
Absar Ahmad Kazmi [Professor, Indian Institute of Technology Roorkee]
BR Gurjar [Professor, Indian Institute of Technology Roorkee]
K Sri Harsha [Co-founder, Kritsnam Technologies]
M Mansoor Ahammed [Professor, SVNIT Surat]
S Shrihari [Professor, National Institute of Technology Karnataka Surathkal, Surathkal]
B Sikka [Senior Consultant, NMCG]
Vinay Kumar [Professor, Indian Institute of Technology Roorkee]
Ashish Mathur [Advisor, Grant Thornton]
Surya S Durbha [Professor, Indian Institute of Technology Bombay]
Pawan K Labhasetwar [Sr. Principal Scientist, NEERI Nagpur]

Mr. Lars-Goran Nilsson

M/S Conjet AB, Sweden



Hydrodemolition = Selective Removal Damaged Concrete is removed down to a pre-set quality level

Guri dam – 3rd largest in the world Repair of spillways in Puerto Ordaz Venezuela

Benefits with Hydrodemolition Provides Longer Lasting Structures

- Creates super bond between old and new concrete.
- Longer lasting and higher quality repairs
- Lower life cycle cost of concrete structure.
- High capacity - One robot outperforms > 25 men with jackhammers.
- Selective removal, removes damaged and leaves sound concrete
- Environmentally acceptable - Noise and dust dramatically reduced.
- Operator friendly - No vibrations No "white fingers"
- Hydrodemolition technology extends the life length equal to lower costs.

Mr. Lars-Goran Nilsson (Director) made a presentation on "Hydrodemolition vs Jackhammers". Hydrodemolition is a technology to remove damaged concrete on sensitive structures by using high pressure water. If Jackhammers are used, it creates micro-cracks in the remaining structure which causes bad bonding with new concrete and consequently the repaired concrete will have a short life span. During the presentation, a few video was also shared which depicted the working of the Hydrodemolition without causing damage either to remaining concrete or the steel bars working as tensile members. However, the company is mostly involved in carrying out works in the field of concrete road repairs, bridge and pillar repairs, dams, railway tunnel, etc. However, no information was provided on rejuvenation of old water and wastewater treatment plant related structures using this method. Maybe useful for O&M companies in transportation sector like roads, ports, etc. and therefore, experts from these sectors may be involved if this technology is considered for ETV process.

M/S IDE Technologies, Israel

The main thrust of the presentation by Mr. Matan Alper (Product Manager) was on developing portfolio of economic, green water treatment solutions for municipalities and industrial sectors with desalination. The presentation highlighted MAX H_2O desalter – a brine minimization technology using reverse osmosis before passing the waste stream for ZLD. They have claimed to reduce the down-stream challenges and cost of treatment. The presentation also dealt with Pulse Flow Reverse Osmosis to avoid usage of chloramines in the RO plants. The company has indicated its presence in Indian market in addition to its business in China, US, Australia and Israel.

Mr. Matan Alper

They have strong presence in India may be considered for ETV process.

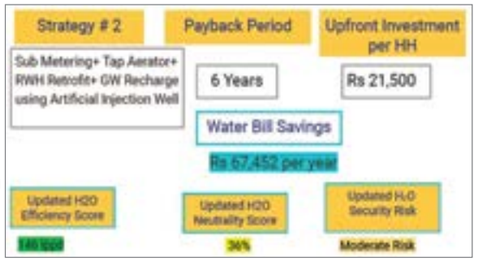
Technology & Innovation Showcase

M/S Virtual Irrigation Academy, Australia

H2O Transformer Scorecard- Jan-Dec 2018

Dr. Bhakti Devi

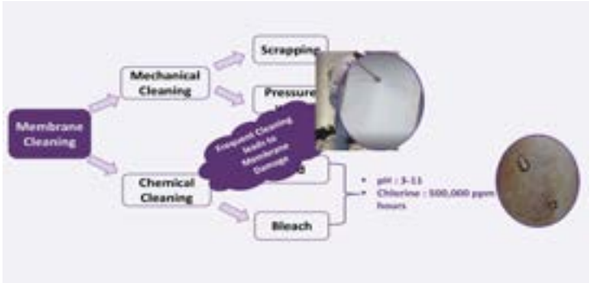
Dr. Bhakti Devi (Head) made a presentation on "Water Demand Management Innovation – Rural & Urban". She presented Chameleon Sensor – an Australian innovation in irrigation water demand management. This sensor is of two types – Chameleon Card and Chameleon WiFi. The Chameleon soil water sensor systems have helped farmers in Pretoria (South Africa) for using precious water resources efficiently and sustainably. The sensor has LED colour indicators which indicate whether soil moisture is adequate or it needs irrigation. She also presented H2O Diagnostics – another innovation in urban water demand management. This tool is designed as a water demand management planning tool for residential, commercial and institutional properties. This tool makes an assessment of current water demand patterns, prepares a scorecard for water security status and develops a water conservation action plan. They have started the pilot studies in the city of Bangaluru which is yet to be completed due to nationwide lockdown since March 2020. Let the field data is obtained and then it may be considered for ETV process.



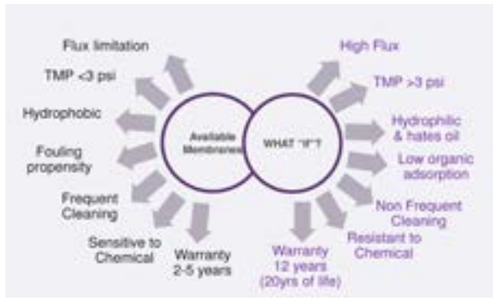
Water Conservation Action Plan

M/S Ovivo, Canada

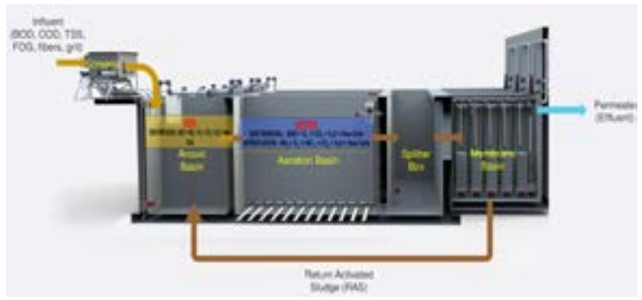
Membranes could be challenging



Maintenance challenge frequent cleaning



Next generation MBR have exceptional properties



Typical MBR design

Mr. Sujith Kumar (GM) presented application of Silicon Carbide Membrane – a next generation of membrane in the treatment of municipal wastewater. These membranes have been made from rocks in place of petroleum – the usual materials for other membranes. This membrane has been claimed to eliminate nicks, tears and cuts – a definite plus point compared to other membranes. This membrane could be pressure washed quickly. The company has also claimed (i) possibility of aggressive chemical cleaning, (ii) handling liquid with pH in the range of 1-14 and (iii) withstanding temperature up to 80 ^{0}C. The company is looking forward to demonstrate its technology in Indian conditions. Hence may be considered for ETV process.

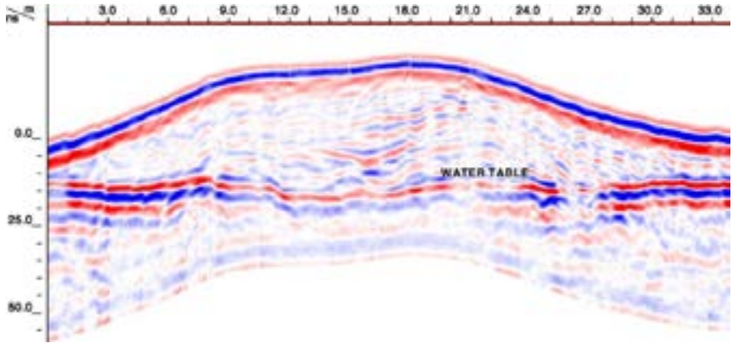
Technology & Innovation Showcase

M/S GSSI, USA

GPR- What is it?

- GPR stands for Ground Penetrating RADAR
- RADAR stands for RAdio Detection And Ranging
- High-frequency electro-magnetic (EM) reflection
- Active technique: emits energy and record the response

Water table mapping



Water table mapping

Mr. Robert Parrillo

Mr. Robert Parrillo (Asia Sales Manager) introduced the company as the leading manufacturer of commercial Ground Penetrating Radar (GPR) systems. The GPR has been used for utility location and mapping, concrete inspection and NDT, transportation infrastructure, geological & archaeological surveys and environmental assessment. He presented a case study from Tunisia for mapping of sewer lines using GPR. They have already sold a number of GPR to many of the Indian academic and research institutes. During interaction with panel, it came out clearly that these systems have a major limitation if the overlaying soil is of hard clay type. The panel also explored the possibility of manufacturing these systems in India as the import is getting tougher day by day, however, the company has no plan of now for having a manufacturing unit located in India. GPRs are now used extensively. Already well established system, it may not be required to undergo ETV process.

Overview

The Track C on Technology & Innovation had six sessions and 30 firms/organizations shared their innovative technologies and processes. Overall, most of the technologies/processes have been developed abroad. Some of the technologies/processes appeared to have gone for full scale applications, while some other are going for pilot testing. A few of the technologies have already been tested in India on a small-scale showing their potential. However, majority of presented technologies/processes are yet to be tested for Indian conditions. Two Indian companies have also presented their technologies with potential, albeit with little performance related data. Hence, there is a need for tie-ups with academic and research institutions by the proponents of these technologies/processes for verifying their performance in Indian conditions. Also, as most of the technologies/processes needs specific components with fixed life span of shorter duration, there is a need to encourage production of these components in India thereby meeting the need of “Make in India” – the call given by the Hon’ble Prime Minister of India. Also India is a laboratory for next generation materials and an emerging leader in Industry 4.0. These companies need to demonstrate faith in India by setting up R & D, manufacturing units in India.

TRACK D

DAY 1:
Thursday, December 10, 2020
18:00-19:15 hrs

MODE:
Virtual

MODERATORS:
Sanmit Ahuja [Expert Member, cGanga]

INTRODUCTION:
Vinod Tare [Founding Head-cGanga]

SPECIAL ADDRESS:
H.E. Gaitri Issar Kumar [Indian High Commissioner to the UK]

KEYNOTE ADDRESS:
UP Singh [Secretary, Jal Shakti]

PANELISTS:
Rahul Tabhane [Country Head, India at UK Export Finance]
Anita Nandi Ray [Chief Representative-India, City of London Corporation]
Mohan Bhuyan [Business Development Lead, Primary Markets India, LSEG (London Stock Exchange Group)]
Lila Thompson [CEO, British Water]
Hirander Misra [CEO and co-founder, Global Markets Exchange Group (GMEX)]
Srini Sundaram [Founder and CEO, Agvesto]

WAY FORWARD:
Rajiv Ranjan Mishra [DG, NMCG]

VOTE OF THANKS:
Rozy Agrawal [ED (Finance), NMCG]

UK-India Partnership: "Financing Global Water Security and Journey to COP-26"

India is at a cusp of a major growth period that will increase the demand for infrastructure financing. The current liquidity crunch in the Indian banking sector can be an inhibitor to this growth. Although green shoots of recovery can be seen amongst banks and lenders, the demand-supply gap of capital requirement is only going to increase.

The world is seeing unprecedented rise in capital that must go towards projects with a higher ESG – Environment, Social and Governance rating. And the UK's financial services sector offers multiple windows to access this global capital pool and a strategic partnership between the eco-systems of the two nations can accelerate the financing of India's infrastructure sector.

However, underpinning this strategic alliance there must also be great synergies and an active dialogue between the countries' respective financial services and industry eco-systems. The Sustainable finance working groups and the Economic and Financial Dialogue between the two nations provide interaction at the highest levels. But more is required to be done particularly with establishment of purpose-built channels for the water and environment sectors. These sectors have their own peculiar underlying commercial models and risks which the markets must not only understand but also develop the right risk management framework.

UK's strengths lie in offering a wide variety of financing structures that includes but not limited to:

- Private equity providing the equity capital needed for PPP/PFI projects
- Debt capital markets that offer access to structured debt as well as a deep green-bond market
- Insurance to provide guarantee and risk management instruments
- Venture finance to fund technology transfer
- Fledgling fintech sector that offers cutting edge and innovative financial instruments

THE ROAD TO COP-26

It is imperative that the water sector is given an equal priority in the global climate change dialogue. Climate change is going to have a significant impact on water resources. Water sector needs to be mainstreamed across all infrastructure development and planning cycles.

It is imperative for the climate leaders to understand and appreciate how global consumption affects water in growth countries such as India. Finished goods such as textiles and manufactured products lead to increased demand for process water as well as increased pollution since many of the factories are unable to afford high end water treatment systems. The costs at which the goods are made available to the rest of the world does not include the environmental costs. It is important to generate awareness as well as governance models to ensure that these costs are internalised, and consumers pay for sustainability.

As the UK prepares for hosting the COP26 in November 2021 in Glasgow, India is taking strides to reach out to the world to highlight a new governance model for the water sector. This model incorporates rivers, eco-systems and nature-based solutions into the larger planning for the water resources. India will invite the global south to create a force multiplier that puts a spotlight on water security, eco-system services and initiates a call to action to bring water higher up on the agenda of the global financial community.

> **THE UK's financial services sector offers multiple windows to access this global capital pool and a strategic partnership between the eco-systems of the two nations can accelerate the financing of India's infrastructure sector**

UK-India Partnership: “Financing Global Water Security and Journey to COP-26”

International Partnerships

Mr Sanmit Ahuja, Expert Member, cGanga welcomed the panel speakers and highlighted the special relationship that UK and India have in with regards to sustainable development. He pointed out that UK’s depth of research, innovation and financial expertise is highly complementary to India’s needs and size of the market.

H.E. Smt Gaitri Issar Kumar, Indian High Commissioner to the UK, gave the keynote address bringing a spotlight on UK-India special relationship in the area of environment and sustainability. She stressed that both countries had a lot to offer to each other in knowledge and market opportunity in areas such as innovation, science, technology and green finance.

Mr Mohan Bhuyan of London Stock Exchange pointed out the depth of capital markets in London, and how Indian companies could tap into the liquidity pools to raise financing for necessary projects. He also highlighted the sustainability and green bond market segments of the London Stock Exchange.

Mr Rahul Tabhane of UK Export Finance pointed out the special funding facilities available for UK companies exporting to India.

Ms Anita Nandi-Ray of City of London Corporation spoke of major green financing solutions and expertise that UK could share with India.

Mr Rozy Agarwal, ED-Finannce, NMCG concluded the session by also mentioning the Clean Ganga charity that will be set up soon in the UK to mobilise funds from the diaspora.

Ms Lila Thompson of British Water pointed out to the MOU between cGanga and her organisation which will act as a bridge between the two countries to get British and Indian water focused technology and engineering companies to collaborate.

Mr Hirander Misra of GMEX group spoke of establishment of a waste exchange in India at the moment and that project is underway. He mentioned that the exchange providing an underlying commodity market for waste products building indices on the back of the data generated from that is a key element to then develop other financial instruments to bring in a wider range of players.

Mr UP Singh, Secretary, Ministry of Jal Shakti shared his experiences of the visit to the UK in 2017 as part of the Namami Gange roadshow and stressed that the interest level generated must also be converted fast into actionable partnerships.

Mr Srini Sundaram of Agvesto shared specialist insurance instruments his organisation is developing for the agricultural market in India.

Ms Gaitri Issar Kumar, Indian High Commissioner to the UK and Mr. UP Singh announced the Ganga Connect exhibition that would take place in multiple cities in the UK in 2021.

US-India Partnership: "Digital Water"

DAY 2:
Friday, December 11, 2020
18:30-20:30 hrs

MODE:
Virtual

MODERATORS:
Sanmit Ahuja [Expert Member, cGanga]

INTRODUCTION:
Vinod Tare [Founding Head-cGanga]

SPECIAL ADDRESS:
Ravi Kota [Minister (Economic), Embassy of India, Washington DC, USA]

KEYNOTE ADDRESS:
UP Singh [Secretary, Jal Shakti]
Ben Grumbles [Secretary of the Environment, State of Maryland]

PANELISTS:
Xavier Chauvot de Beauchene [Lead Water and Sanitation Specialist, The World Bank]
Usha Rao Monari [Senior Advisor, Blackstone Group]
Michael Sack [President & CEO, TeraCode]
Biju George [Executive Vice President, Operations and Engineering, DC Water]
Devesh Sharma [Managing Director, Aquatech International]
Luis Montestruque [Vice President, Digital Solutions, Xylem]
Robert Teich [Senior Marketing Director, Analytics at Xylem Inc.]
VV Rao [Water Resources Geospatial Technologist, NRSC, ISRO]
Prakash Chauhan [Director, IIRS, Dehradun]

WAY FORWARD:
Rajiv Ranjan Mishra [DG, NMCG]

VOTE OF THANKS:
Rozy Agrawal [ED (Finance), NMCG]

Digital information and analytical systems will play a critical role in the management and governance of water resources as well as water infrastructure.

The digital systems are being used already to monitor plants and city water distribution networks. All smart city projects are utilising digital platforms:

- To assess leakage points so those maybe plugged immediately to reduce water losses
- To study water usage patterns that help utility companies better understand demand/supply dynamics
- To implement digital water meters to be able to increase revenue water

There is, however, another major dimension emerging which is the use of digital platforms in the area of water governance and water resource management that can greatly benefit the water sector in India.

As India moves towards evidence-based policy making, the need for decision support systems and artificial intelligence tools to aid policy makers has never been greater. Policy makers need to make decisions based on availability of data from multiple sources that is then weaved into a decision model for them to get data points, draw inferences and make decisions with confidence. The need is even more acute in India since water is a subject devolved down to the state level and it is fragmented across many ministries and departments for instance urban affairs, agriculture, inland water-ways, hydropower and industry. More often than not there are differences and divergences in fragmented datasets managed by different departments that lead to confusion, delays and at times contradictions. Integrated data systems can address this issue that will enable faster project rollout and better information to assess risk.

The rejuvenation of river systems requires mapping and cataloguing water bodies small or big. Overlaying the GIS data with water quality, quantity data and understanding how it changes over a period of time can give river basin authorities a great level of intelligence to plan the water related interventions they plan to make. Today there is technology that can weave together data from different sources including satellites, drones and sensors placed across the entire basin. Numerous analytical applications can be built upon this platform that can usher in a phenomenal digital revolution.

United States can be a great ally to building India's digital foundation for the water sector.

POLICY MAKERS NEED

to make decisions based on availability of data from multiple sources that is then weaved into a decision model for them to get data points, draw inferences and make decisions with confidence

US-India Partnership - “Digital Water”

International Partnerships

Mr Ravi Kota, Minister Economic, Embassy of India in Washington DC provided the opening special address and welcomed the India-USA partnership on Digital water sector.

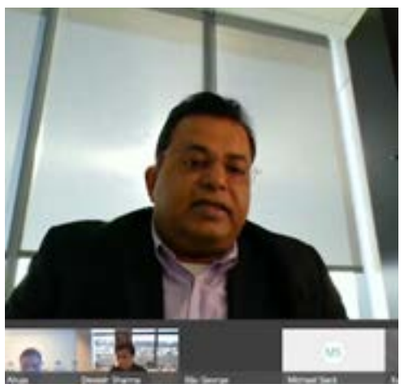
Mr Ben Grumbles, Secretary of Environment, State of Maryland, in his keynote address, mentioned that even in his state water is a major issue and that we must all share knowledge with each other to address the climate problems.

Mr Xavier Chauvot De Beauchene, Sr. Water Specialist, World Bank, spoke about the importance of collecting and analysing data for delivery of good governance.

Ms Usha Rao-Monari, Sr. Advisor, Blackstone Infrastructure Group and Board Member, spoke about how financing at scale requires long term commitment from the Government and specialist PPP models that encompass the adequate risk/reward mechanisms.

Mr Michael Sack, Founder and CEO, Teracode spoke about the work his firm has been doing in developing the right decision support system for River Basin Management.

Mr Biju George, EVP Operations and Engineering, DC Water, told the audience of how his utility was leveraging digital infrastructure to deliver efficiency at scale.



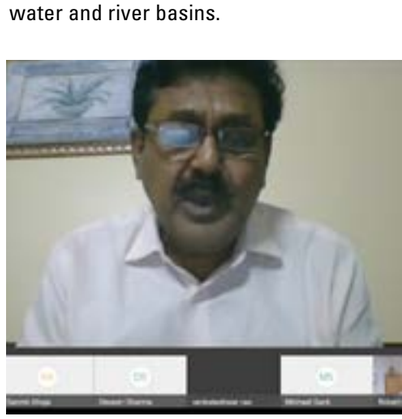
Mr DP Mathuria, ED-Technical, NMCG said that developing decision support systems happens to be the most important topic for river basin authorities and regulators.

Mr Devesh Sharma, MD Aquatech International, said that digital infrastructure can greatly enhance the capabilities of cities to manage both industrial and municipal wastewater streams.

Mr Robert Teich, Sr. Marketing Director, Analytics, Xylem, pointed out how his organisation is helping utilities across the world in developing continuous and real time monitoring systems for better compliance and enforcement.

Dr Luis Montestruque, VP Digital Solutions, Xylem, told the audience how monitoring of grey water infrastructure can save utilities and cities a lot of capital.

Dr Prakash Chauhan, Director Indian Institute of Remote Sensing (ISRO), Dehradun, and Dr VV Rao, Group Director- Water Resource Division, NRSC, ISRO spoke about the great capabilities India is developing in remote sensing of natural assets such as water and river basins.



Norway-India Partnership - “Harnessing Riverine Circular Economy Potential”

DAY 5:
Monday, December 14, 2020
13:30-14:00 hrs & 14:00-15:00 hrs

MODE:
Virtual

MODERATORS:
Sanmit Ahuja [Expert Member, cGanga]

INTRODUCTION:
Vinod Tare [Founding Head-cGanga]

SPECIAL ADDRESS:
H.E. B Bala Bhaskar [Indian Ambassador to Norway]
Karina Asbjornsen [Norwegian Embassy in New Delhi]

KEYNOTE ADDRESS:
UP Singh [Secretary, Jal Shakti]

PANELISTS:
Ole Henaes [Regional Director Asia and Middle East, Innovation Norway]
Gargi Pareek [Innovation Norway, India]
Ola Stedje Hanserud [NIBIO]
Morten Hegge [Regional Director, Cambi]
Uday Kelkar [Delhi Jal Board (DJB)]
Harald Kleiven [Sales Director Emerging Markets at Cambi Group]
Indra N Mitra [Director, Cambi India]

WAY FORWARD:
Rajiv Ranjan Mishra [DG, NMCG]

VOTE OF THANKS:
Rozy Agrawal [ED (Finance), NMCG]

Implementing circular economy principles in or around a river basin ecosystem has its own set of challenges. For decades rivers have been just used for carrying waste-water or extraction of water for agricultural purposes. Either ways the river ends up getting damaged by pollution or fracturing/drying up.

Sustainable development principle is central to circular economy. The riverine eco-system.

The implementation of circular economy principles in a river system must follow the following principles:

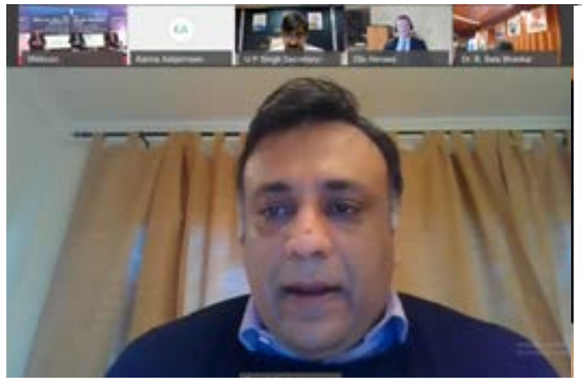
- Rivers are not carriers of waste-water. This is even more true in India as many rivers are not perennial rivers. This requires stopping of both municipal and industrial pollution from entering the river streams. If the local economy allows the latter, then recycling should be definitely be encouraged and if not, then the water must be treated before discharged.
- Municipal sludge cannot be dumped into the river at all. This would require creating alternative use for the sludge. The processes to convert sludge into energy or recover nutrients from it would depend upon the local regulations and market conditions. Where the sludge streams are free of heavy metals or industrial effluents, applying nutrient recovery processes would work well. This will deliver the fertilizer
- Solid waste particularly, the non-biodegradable one cannot also be dumped into the river. There are proven technologies and models for resource extraction and/or energy generation from waste streams. Alternatively, waste can be processed and utilised in construction industry.

There are many other advanced circular economy solutions and models that India can develop jointly with Norway. These include but are not limited to:

- Utilising sludge waste, solid waste to generate hydrogen that can power heavy transport such as buses, trucks and even river transport.
- Run of the river hydro-power systems, that do not fracture the river systems.
- Riverine and marine plastics to be recycled and reused.

The solutions do not just include technology, but also policy, economic and financial models to enable the implementation part.

SUSTAINABLE
development principle is central to circular economy



EU-India Partnership - “Water Energy Land Nexus and High Impact Projects”

DAY 5:
Monday, December 14, 2020
18:00-18:45 hrs & 18:45- 19:45 hrs

MODE:
Virtual

MODERATORS:
Sanmit Ahuja [Expert Member, cGanga]

INTRODUCTION:
Vinod Tare [Founding Head-cGanga]

SPECIAL ADDRESS:
H.E. Ugo Astuto [EU Ambassador to India]
H.E. Santosh Jha [Indian Ambassador to the EU]

KEYNOTE ADDRESS:
UP Singh [Secretary, Jal Shakti]

PANELISTS:
Neelima Alam [Technology Missions Division, Ministry of Science & Technology, GoI]
Jan Grimbrandt [Bosan]
Donal Cannon [European Investment Bank (EIB)]
Kamilla Kristensen Rai [Counsellor at the Delegation of the European Union to India]

WAY FORWARD:
Rajiv Ranjan Mishra [DG, NMCG]

VOTE OF THANKS:
Rozy Agrawal [ED (Finance), NMCG]

Water’s interplay with energy and land systems can no longer be seen in isolation but must be looked at from a systems lens. However, from a riverine lens it is imperative to put the river at the centre of this system to assess how the river basin (watershed) is managed effectively and efficiently.

The water-energy nexus has the dimensions of using water for producing energy for example through hydropower. The critical point to note here is that large hydro-power systems particularly those placed in series on a river tend to fracture the river system and it is necessary to keep the system balanced through a minimum level of e-flows (environmental flows). Run of the river hydropower systems are to be encouraged as they will have minimal environmental footprint and can bring electricity to remote places in the country as well.

The energy-water nexus manifests in the use of electricity in water supply and water treatment. Energy is the most significant cost in any form of water consumption whether by human beings or by industry or for land (irrigation). Applying circular economy principles can reduce the energy spent in water supply and treatment systems. This also has a major direct impact on the river systems as less pollution is discharged thereby keeping the river quality healthy.

The water-land nexus dimension puts irrigation at the forefront. By applying thrift in irrigation, or using water efficient practices, can reduce the amount of water consumed and thereby having a direct impact on the water quantity in the river systems.

The land-water nexus dimension plays out in how a watershed, river basin is managed mostly from an environmental perspective. Degradation in land use, such as through forest erosion, leads in increased water flowing down the valleys into the river systems. Indirectly carbon emissions from land use activities leads to changing water cycles, which lead to flooding.

The land-energy nexus plays out through the use of land for energy production such as for solar, wind and other energy systems. Agricultural residue, such as biomass, can also be used in generation of energy.

In the reverse direction energy-land linkage is understood through the lens of energy utilisation in land-based anthropogenic activities such as in cities and human dwellings and land cultivation.

EU-India cooperation cuts across all of the sectors. The most relevant partnership in this area, from a river system viewpoint is the India-EU Water Partnership (IEWP) which is an outcome of the ‘Joint Declaration on Water’ adopted by India and the EU on 30 March 2016 during the 13th EU-India Summit in Brussels, to enhance cooperation on water issues, including ‘Clean Ganga’ programme of the Government of India. At the summit, Prime Minister Narendra Modi met members of the European Union (EU) represented by the President of the European Council, Donald Tusk and the President of the European Commission (EC), Jean-Claude Juncker.

Lower Mekong - India Partnership - “Partnership of civilisational river economies for water security and shared prosperity”

DAY 6:
Tuesday, December 15, 2020
09:00 -10:00 hrs & 18:00 - 18:45 hrs

MODE:
Virtual

MODERATORS:
Sanmit Ahuja [Expert Member, cGanga]
Jas Sohl [Chief Strategy Officer, CEI]

INTRODUCTION:
Vinod Tare [Founding Head-cGanga]

SPECIAL ADDRESS:
H.E. Devyani Khobragade [Indian Ambassador to Cambodia]

KEYNOTE ADDRESS:
UP Singh [Secretary, Jal Shakti]
Hon. Cham Prasidh [Minister of Industry, Science, Technology and Innovation, Government of Cambodia]

WAY FORWARD:
Rajiv Ranjan Mishra [DG, NMCG]

VOTE OF THANKS:
Rozy Agrawal [ED (Finance), NMCG]

The Ganga river basin is a home to over 600 mn people. The river in India travels over 2500 kms, across 5 states, and is a trans-international boundary river as well. The basin catchment is spread over almost 1 mn sq. km area covering nearly 25% of India’s landmass.

The Lower Mekong river basin is spread over nearly 800,000 sq. kms and covers 79% of the total basin area. The Lower Mekong basin nations include Myanmar, Laos, Thailand, Cambodia and Vietnam.

Many of the issues are common to the Ganga and Mekong River basins.

The first is the economic importance of the river system in the respective regions/countries. The Ganga river system makes fertile 57% of India’s agricultural lands. This is quite important as nearly 40% of India’s population is based in this region. Similarly, 60% of the population in the Lower Mekong depend on the river for the water related economy.

The Lower Mekong eco-system is the 2nd most bio-diverse in the world after the Amazon as it supports the largest freshwater fishery in the world. The Ganga basin has multiple habitat zones and have many endangered species as a result of the degrading biodiversity.

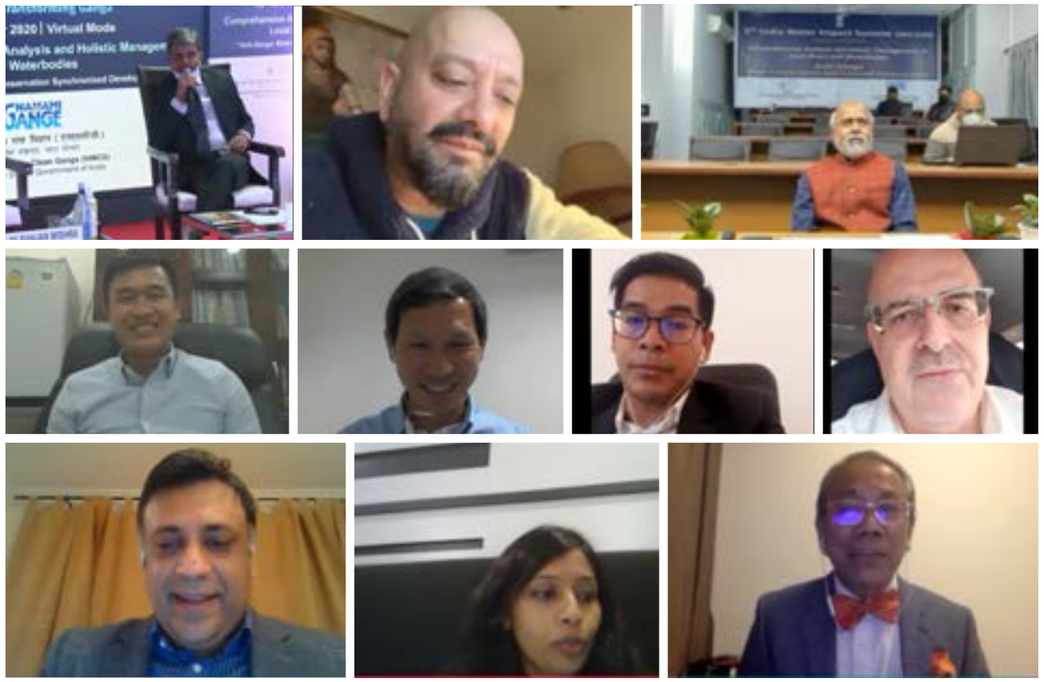
Both river systems are trans boundary and trans-states making the governance model quite complex particularly because of stresses between upper and lower riparian. There is the added water demand conflict between agriculture, municipal and industry.

The proposed partnership between Lower Mekong nations and India is based on the common themes, challenges and opportunities. The sides are coming together to share their experiences and knowhow. India further proposes to invite its industry to participate in building water and sanitation infrastructure in the lower Mekong region using PPP models and innovative financial structures. Additionally, India wishes to share all the global portfolio of technologies it is implementing in the Ganga River basin.

This partnership shall be implemented under the existing Ganga – Mekong cooperation mechanism.

INDIA PROPOSES

to invite its industry to participate in building water and sanitation infrastructure in the lower Mekong region using PPP models and innovative financial structures



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