

INDIA WATER FORUM | 2011



Water Security and Climate Change:
Challenges and Opportunities

Conference Proceedings

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The Energy and Resources Institute



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Challenges and Opportunities



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MESSAGE



I am very happy to provide this brief input for the proceedings of the India Water Forum. This event is symbolic of TERI's enhanced activities in the water sector. With an increase in population and higher incomes, the demand for water in India is going up rapidly. Besides, the challenge of food security places an ever increasing demand on water for agriculture. At the same time the impacts of climate change have direct implications for the availability of water in this country as in other parts of the world. While water is clearly an issue of local relevance in different locations, the global dimensions of this vital resource would have an important bearing on policies that need to be adopted and innovations that need to be developed and disseminated to deal with challenges in the future. The India Water Forum which attracted some of the most accomplished professions in the field was a unique event in which an effort was made to come to grips with the nature and magnitude of challenges in the water sector in the world as a whole, but more particularly on the Indian subcontinent.

These proceedings digest the rich material presented and discussed during the Forum, which TERI hopes to repeat on a regular basis, and it is hoped that by drawing in all the relevant stakeholders in the field, we may be able to mount effective efforts to deal with this problem worldwide and certainly within this subcontinent.

– R K Pachauri



Even as water sustains all life, for most part we tend to either take this precious gift of nature for granted or use it in profligate ways that are unsustainable. This has created serious water shortages and problems of water quality in many parts of the world, including India. There are even fears of water becoming a major source of societal conflict in times to come. It is, therefore, imperative to bring water onto the global and national agenda with a view to charting a sustainable path for the future. The India Water Forum represents an effort by TERI to create a broad-based platform for policy-makers, experts, scholars, practitioners, and the civil society to deliberate on water-related issues, generate public awareness, and also identify strategies for sustainable utilization and management of our water resources. I sincerely hope that this Conference will make a significant contribution in carrying this mission forward and extend a very warm welcome to all our guests and participants for a very productive dialogue.

– Ashok Jaitly

CLIMATE CHANGE AND WATER



With an economy closely tied to its natural-resource-base and climate-sensitive sectors such as agriculture, water, and forestry, India faces a major threat because of the projected changes in climate. Crucial sectors in India like agriculture, water resources, health, sanitation, and rural development are likely to be affected by climate change. India's large population primarily depends on climate-sensitive sectors like agriculture and forestry for their livelihood. The majority of the vulnerable population of India is poorly equipped to cope effectively with the adversities of climate change due to low capabilities, weak institutional mechanisms, and lack of access to adequate resources.

At the national level, increase of c. 0.4°C has been observed in surface air temperatures over the past century. A warming trend has been observed along the west coast, in central India, the interior peninsula, and north-eastern India. However, cooling trends have been observed in north-west India and parts of south India.

While the observed monsoon rainfall at the all-India level does not show any significant trend, regional monsoon variations have been recorded. A trend of increasing monsoon seasonal rainfall has been found along the west coast, northern Andhra Pradesh and north-western India (+10% to +12% of the normal over the 100 years) while a trend of decreasing monsoon seasonal rainfall has been observed over eastern Madhya Pradesh,

north-eastern India, and some parts of Gujarat and Kerala (–6% to –8% of the normal the 100 years).

Sea level rise has been observed to increase by 0.4–2 mm/year along the Gulf of Kutch and the coast of West Bengal. However, relative decrease along the Karnataka coast has also been observed.

Changes in key climate variables, namely temperature, precipitation, and humidity, may have significant long-term implications for the quality and quantity of water. The most significant changes are likely to occur in the glacier fed river systems, due to the melting of the Himalayan glaciers. Changes are likely in the long-term lean-season water flows of large snow- and glacier-fed river systems of the Brahmaputra, the Ganga, and the Indus.

A decline in total run-off for all river basins, except Narmada and Tapti, is projected in India's NATCOM I. A decline in run-off by more than two-thirds is projected for the Sabarmati and Luni basins.

Heavily populated regions such as coastal areas are exposed to climatic extremes and large falls in sown areas in arid and semi-arid zones, of which nearly two-thirds are drought-prone. Large areas in Rajasthan, Andhra Pradesh, Gujarat, and Maharashtra and comparatively small areas in Karnataka, Orissa, Madhya Pradesh, Tamil Nadu, Bihar, West Bengal, and Uttar Pradesh are frequented by drought. About 40 million hectares of



land is flood-prone, including most of the river basins in the north and the north-eastern belt affecting about 30 million people on an average each year.

A mean sea level rise of 15–38 cm is projected along India's coast by the mid- 21st century and of 46–59 cm by 2100. India's NATCOM I assessed the vulnerability of coastal districts based on physical exposure to SLR, social exposure based on population affected, and economic impacts. In addition, a projected increase in the intensity of tropical cyclones by 15% poses a threat to the heavily populated coastal zones in the country (GoI, 2004).

Government initiatives to help mitigate the effects of climate change

For developing countries like India, adaptation requires assisting the vulnerable population during adverse climate events and empowering them to build their lives and to cope with climate risks in the long term. In this context, several of India's social-sector schemes emphasize livelihood security and welfare of the weaker sections. India implements a series of central and centrally sponsored schemes under different ministries and departments aimed at achieving social and economic

development. At present, while none of the schemes is explicitly referred to as an Adaptation schemes, many contain elements (objectives and targets) that clearly relate to risks from climate variability.

The effort of the Indian government is to mainstream the climate impacts into its sectoral policies. Several ongoing efforts address some of these vulnerability concerns, although they are primarily driven by the objective of sustainable livelihoods and poverty alleviation.

Outlined in the sections below are some of the policies, programmes, and regulations implemented by the Government of India that have the potential to enhance the resilience of communities to cope with extreme weather conditions and climatic variability.

Water resource conservation is the backbone of the government's programme on agriculture and rural development. Several initiatives have been targeted towards watershed development and management. Promotion of water-harvesting measures including rejuvenation and revival of traditional water storage systems is high on the water conservation agenda. The National Water Policy (2002) stresses that non-conventional methods for utilization of water, including

inter-basin transfers, artificial recharge of groundwater, and desalination of brackish or sea water, as well as traditional water conservation practices like rainwater harvesting, including roof-top rainwater harvesting, should be practised to increase the utilizable water resources. The Government of India has also circulated a model bill to state governments for regulating the extraction of groundwater. The government has also urged state governments to pass appropriate legislation to enable regulatory measures to protect sources of drinking water in rural areas, thereby restricting overexploitation of groundwater.

Involvement of the community in management of water resources is also being increasingly realized and encouraged. To be able to cope effectively with floods, the government has outlined several initiatives that promote the implementation of flood-proofing measures including repairs and protection of embankments and prevention of settlements in the flood zones.

Programmes such as the **Drought Prone Areas Development Programme** and its precursors have addressed issues of agricultural productivity in rainfed areas. Watershed-based programmes for agriculture, forests, and rural development to conserve soil and water, improve productivity, and enhance ecosystem resilience have now been implemented for several years.

In coastal regions, **coastal regulation zones** have been formulated that indicate the sensitivities of coastal ecosystems and prevent their exploitation for development as well as for their natural resources including groundwater. Restrictions have been imposed in the area between 200 m and 500 m of the HTL (high tide line) while the area up to 200 m has been declared as a 'no development zone'. The coastal zone regulations are under major review, which will also take into account the vulnerability to sea-level rise.

Climate change effects in South Asia

The South Asian region is also highly sensitive to the consequences of climate change. It is known to be the most disaster prone region in the world supporting a huge population of more than 1.3 billion (UNEP 2003). This is critical as climate predictions for the future highlight increase in frequency and intensity of extreme weather events like droughts and floods (IPCC 2001);

indicative of the huge population that is likely to be exposed and affected in the region. Analysis of rainfall data for India highlights the increase in the frequency of severe rainstorms over the last fifty years. The number of storms with more than 100 mm rainfall in a day is reported to have increased by 10 percent per decade (UNEP 2007). Tendencies of increase in intense rainfall with the potential for heavy rainfall events spread over few days are likely to impact water recharge rates and soil moisture conditions. Despite this, a decade of drought is also marked with certain regions in Asia getting affected. These conditions exacerbate and skew water availability across regions worsening conditions in regions that are already water stressed. Rapid depletion of water resource is already a cause for concern in many countries within the region. The report highlights that in South Asia alone, 2.5 billion people will be affected with water stress and scarcity by the year 2050 (HDR, 2006).

The Himalayan range contains high altitude glaciers that supply water to many rivers in Asia. These rivers provide water to more than half of the world's population. Many people in Asia are dependent on glacial melt water during dry season. Accelerated glacial melt questions the very perennial nature of many of the Himalayan flowing rivers. This is likely to have huge implications on those dependent on the resource affecting water availability for agricultural purposes. In Nepal and Bhutan, melting glaciers are filling glacial lakes beyond their capacities contributing to Glacial Lake Outburst Floods (GLOFs) (UNEP 2007).

According to the IPCC, the greatest vulnerability to climate change is in unsustainably managed ecosystems that are currently water stressed. By 2050, the annual runoff in the Brahmaputra is projected to decline by 14%, and that in the Indus by 27% (IPCC 2001), which will have tremendous downstream consequences. Increased warming might result in increased flows initially with reduced flows later as the glacier disappears.

India, Bhutan and Nepal are concerned about the reduction in flow of snow-fed rivers (respective NCs), while Maldives is threatened by saltwater intrusion into freshwater (NC of Maldives). In Pakistan, a 6% decrease in rainfall will increase the net irrigation requirement for

wheat by 29% (NC of Pakistan). Increased glacial melt due to warming is also predicted to affect river flows.

Bangladesh

As floods in Bangladesh are caused by intense monsoon precipitation over the basin areas of the Ganges, Brahmaputra and Meghna (GBM) rivers, future changes in precipitation regime have four distinct implications:

1. the timing of occurrence of floods may change, with a possible change in the seasonality of the hydrological cycle
2. increased precipitation in the GBM basins may increase the magnitude, depth, and spatial extent of floods
3. timing of peaking in the major rivers may also change that may change the likelihood of synchronization of flood peaks of major rivers
4. increased magnitude, depth, extent and duration of floods will bring a dramatic change in land-use patterns in Bangladesh.

A study carried out under the BDCLIM (Bangladesh Climate) project sought to examine possible changes in flooding in Bangladesh under a given climate scenario. IPCC (2001) indicates that the average annual runoff in the Brahmaputra basin would decline by 14% by the year 2050 as a result of climate change. Nishat (2002) made an attempt to examine the implications of climate change for the National Water Management Plan of Bangladesh. Impacts include excessive rise in evaporation rates, reduction in dry season trans-boundary flows resulting in an increase in irrigation water requirements, sea level rise of 0.5m to exacerbate drainage congestion, and other potential impacts such as more frequent flash floods, higher frequency of tropical cyclones, rise in storm surge depths, and slower accretion of new coastal lands.

Bhutan

The availability of water in Bhutan is heavily dependent on heavy rainfall, glaciers or snow, land use practices, and user demand. A reduction in the average flow of snow-fed rivers, combined with an increase in peak flows and sediment yield, would have major impacts

on hydropower generation, urban water supply, and agriculture. An increase in rainfall intensity may increase run-off, enhance soil erosion, and accelerate sedimentation in the existing water supplies or reservoirs.

Nepal

A preliminary analysis of river discharge shows decreasing trends for Karnali and Sapta Koshi but increasing trends for Narayani (DHM 2004).

Maldives

The population of Maldives mainly depends on groundwater and rainwater as a source of freshwater. Both of these sources of water are vulnerable to changes in the climate and sea level rise. With the islands of the Maldives being low-lying, the rise in sea levels is likely to force saltwater into the freshwater lens. The groundwater is recharged through rainfall. Although the amount of rainfall is predicted to increase under an enhanced climatic regime, the spatial and temporal distribution in rainfall pattern is not clear (Ministry of Environment and Construction 2005).

Pakistan

Wescoat (1991) studied the potential impacts of climate change on the Indus River basin. The study concluded that the total annual run-off from the upper basin is likely to increase by 11% to 16%. It estimated that although increased run-off could be advantageous for water supply and hydropower production it could aggravate problems of flooding, waterlogging, and salinity in the upper basin. Also, even with an overall water surplus, shortages might occur in local areas of the highly productive Punjab rice-wheat zone and in the unglaciated valleys of the upper basin. These areas currently lack adequate storage, conveyance, and irrigation management. Studies also indicate a negative impact on cotton, detrimental to the economy as it is the main cash crop of Pakistan.

Sri Lanka

Studies indicate that much of the water from heavy rainfall events in Sri Lanka would be lost as run-off to the sea. Further, the country faces the challenge of coastal inundation due to rise in sea level.

INDIA WATER FORUM 2011



The Energy and Resources Institute (TERI) in association with the Ministry of Water Resources organized the first “India Water Forum” (IWF), an annual international water convention to address the dynamics of water and climate change. In its inception year, the IWF theme was: ‘Water Security and Climate Change: Challenges and Opportunities’. The theme of IWF 2011 has great significance in today’s world as climate change, being a global phenomenon, calls for collective action and knowledge sharing across countries. The aim of IWF 2011 was to explore vast opportunities in developing technically viable and economically feasible solutions for sustainable governance and management of water resources.

Climate change and its impacts on groundwater, ocean, rivers and glaciers are being felt by fragile ecosystems and vulnerable societies across the world. Enhancing the adaptive capacity of countries for coping with the impacts, risks and uncertainties of a changing climate and climate extremes is the most important challenge for our planet. In this context, the organization of forum envisaged a series of interactive sessions with policy makers, industrial experts, environmentalists, researchers, academicians, students and the general public on a common platform. This global convention also aimed to showcase advanced knowledge and successful technologies developed in different countries and regions, with the aim of promoting international

knowledge network and partnerships for addressing challenges related to Water Security and Climate Change.

Through a global platform like IWF, India can take a lead in addressing water resource management and governance challenges which will help the society move together in a common direction and develop strategies and solutions that are applicable on a global scale.

Objectives

- Share knowledge and experiences of policy makers, utility engineers, water resource development planners, managers, consultants, academicians, environmentalists, users, technology provider etc. on the theme of Water Resources Development with climate change
- Increase awareness about the depleting water resources and efforts to conserve and manage it in an environmentally and socially acceptable way.
- Provide an opportunity to empower decision makers with right knowledge and its application
- Discuss technological advancement that are taking place in water resources development, water storage, water quality & purification issues, waste water treatment & reuse etc.
- Develop close working relationship between experts from users and developers of water resources and all other concerned for future consultations, assessment of problems and for finding out remedial solutions
- Water supply, sanitation and health linkages



Water Convention

The India Water Forum 2011 aimed at exploring new strategies & technologies in the Water Sector while being eco-friendly and ensuring sustainable development. Water convention during IWF 2011 had a range of technical sessions to discuss upon various issues on the current status of water resources and proper management plans that could assist in developing appropriate strategies.

The convention received the enthusiastic response from policy makers, industrial experts, researchers and water practitioners who presented their ideas on the challenges of climate change for water security and opportunities. Discussions, debates and dissemination of information by various water sector stake holders presented new eco-friendly and sustainable strategies

and technologies in this sector. The technical sessions comprising of various parallel sessions were grouped under the following thematic areas.

- I. Challenges and Opportunities for Global Water Security: An overview
- II. Water Vulnerabilities, Resilience and Adaptation
- III. Regional Water Security, Resource Use & Allocation
- IV. Climate Change Impacts on Natural Water Systems
- V. Water Quality and Health
- VI. Water and Sanitation in rural context
- VII. Water and Food Security
- VIII. Sustainable Cities, Water Supply & Distribution
- IX. Role of Science and Technology in Water Security
- X. Policy, Governance and Regulatory Framework





SESSION - 1

CHALLENGES AND OPPORTUNITIES FOR GLOBAL WATER SECURITY: AN OVERVIEW





Climate change has been widely recognised as the most severe long-term threat to development for the present and future generations. The changing climate exacerbates the water management problems worldwide through its impact on melting glaciers, rising sea levels, variable rainfall and extreme events like floods and drought, and presents barriers to the transition from poverty to prosperity. The India Water Forum 2011 started with the session to address these issues from a global perspective and identify the broad parameters for sustainable adaptation strategies.

The session catered to all the dimensions of water security with global as well as the community based perspectives in the era of climate change. Some of the major challenges faced in the present scenario for Global water security spoken about were Exponential Population growth, Rapid Urbanization and Industrialization.

This session was chaired by **Ambassador C Dasgupta** – Distinguished Fellow- Resources Regulation and Global Security Division, TERI, New Delhi.

Experts who presented insights on the subject included

- **Dr. Y.K. Alagh**, Chairman, Institute of Rural Management (IRMA)
- **Dr. Colin Chartres**-Director General–International Water Management Institute (IWMI)
- **Mr. Arjun Thapan**- Sr. Advisor – ADB, Manila
- **Dr. Joe Madiath**- Founder & Executive Director- Gram Vikas
- **Mr. Ganesh Pangare**- Coordinator, IUCN, Asia

Interventions

In his keynote address **Dr. Y.K Alagh** gave three major propositions starting with agricultural trade being important for water security as trade is sustainability enhancing. He further emphasized the importance of community based organizations for regional sustainable development. He ended by saying that “some water is life giving and should be given to households” wherein he proposed for setting standards for water usage at individual or household level.

Dr. Colin Chartres primarily addressed the question “Why climate change adaptation is all about water”. He introduced the “Global Paradox” of feeding the 2.5 billion people more with lesser water for agriculture than we have now in the era of climate change. He also stated that major drivers of food and water security





include population growth, population density and climate change. He mentioned that the predictive gap between demand and supply of water for India in 2030 will almost be 50%. Vulnerability to climate change must be modeled and mapped. This vulnerability assessment must aid policy makers and management of resources. He concluded that significant improvement in infrastructure for water storage is required and water governance system need to adapt to changing patterns.

Mr. Arjun Thapan noted that water security is not a subject for the future – it is here with us today in Asia, and most certainly in India. For India although water is abundant, almost 2/3 of the available water serves only 1/3 of its population. Also, the cost of addressing water related issues amounts to a massive 6.4% of India's GDP.

He also stated that “Water security is not simply about enough water per capita however, Water and Energy are closely related.” He raised the issue of deteriorating Water quality and its severe impacts on ecosystem and habitat. Therefore, Green Engineering projects are a good and sustainable way to begin.

Dr. Joe Madiath started by saying “Indian guidelines say people in rural areas require 40 litres of water per capita per day which is 80 liters for people settled in urban areas.” He thus emphasized that equity is just spoken about and not truly justified since in India, the concept of “equity” is not well defined and is not put in proper perspective. Schedule castes and especially schedule tribes are the worst affected by water access. He said that a system was needed that bridged this divide. So he proposed work to be primarily done





at grassroots level for making a global impact. He discriminated water into water for living which entitles water security to everybody for drinking and sanitation, and water for production. He also suggested that a sustainable mechanism for Renewable Water needs to be created.

Mr. Ganesh Pangare elaborated the value of investing in natural infrastructure for regional growth. He stated that “If natural infrastructure is stable the other things would eventually follow”, hence he emphasized on Investment in natural infrastructure by giving an example

of a Protected watershed on the periphery of Beijing that meets 75% of the city’s water demand. He added that the term “water security” had a complex definition and that water was essential for *Food Security, Livelihood Security* and *Environmental Security*. With regard to Groundwater, he revealed that even in water surplus regions, Groundwater is a serious issue, both in terms of quality and quantity and that policy debates needed to focus on this problem. Linkages between policy makers and financiers must be established to illustrate why it is so important to *invest* in water. He gave a new dimension to the session by introducing water-food-energy nexus as one of the emerging issues. He spoke about 3 A’s of water security i.e. **A**vailability, **A**ccess and **A**ddressing the conflicts of use. He ended by saying that for it all to function, it is essential to get the governance framework working efficiently and correctly.

Deliberations

There were a wide number of questions ranging from autonomy and accountability in science and technology, policies and implementation in waste water management, water treatment to avert water borne diseases, efficiency and production factors in water pricing and sustainable water use in agriculture.



SESSION - 2

WATER VULNERABILITIES, RESILIENCE AND ADAPTATION





The focus for this session was on vulnerabilities and resilience of natural ecosystems to climate extremes, associated risks and uncertainties. The objective of the session was to build upon the existing knowledge and to learn from successful adaptation strategies that could lead to informed policy for planned adaptation. Some of the questions to be deliberated include;

- What is the state-of-the-art in the region for assessing climate extremes and hydro-meteorological disasters and how can the gaps be met?
- How can a better understanding of the impacts, better predictability and informed policy help in disaster risk reduction and disaster management?
- What are the institutional mechanisms for better inter-agency coordination, both horizontally and vertically, to ensure disaster resilient development in vulnerable regions?
- How can dialogue and cooperation be promoted amongst the scientific community, policymakers, developmental practitioners and vulnerable communities for disaster risk reduction and adaptation?

This panel was chaired by **Prof. A.K. Gosain** – Head of Department, Department of Civil Engineering, IIT-Delhi.

The interventions in this session were made by eminent Personalities & scientists such as

- **Dr. Tim Neely** Chief, Environment, Science and Technology, US Embassy
- **Mr. P G Dhar Chakrabarti**, Executive Director, National Institute of Disaster Management, New Delhi
- **Mr. Patrick Yadauga**, Vice President (Supply Chain), Hindustan Coca-Cola Beverages Private Limited (HCCBPL), India

- **Dr Krishna Kumar**, FASc NOAA-CIRES Visiting Research Scientist NOAA/ESRL/PSDI
- **Dr Arabinda Mishra** Director, Earth Science and Climate Change Division The Energy & Resources Institute, New Delhi
- **Dr Eddy Moors** Team Leader, ALTErrA Earth System Science and Climate Change Group, Centre for Water and Climate, Wageningen University and Research Centre, The Netherlands
- **Dr Mats Eriksson** Project Manager Stockholm International Water Institute, Stockholm
- **Mr Krunal Negandhi** Asst. V.P - Projects (Environment) Lavasa Corporation Limited, Hindustan Construction Company

Interventions

In his opening remarks, **Dr Gosain** addressed the issue of climate change impact and stress on water resources. He presented his work on hydrological simulation of the Ganga basin. Through the model, he simulated the consequences of drought as well as flood conditions in the basin for future but pointed out that the model did not give solutions to problems. He emphasized that what was needed to arrive at solutions is a common framework for integration of information from different sectors which he says is possible through the use of current day technology, GIS being one. Base information has to be good.

“If we need to put our policies in proper place, the base information about the area must be correct.”



Dr Tim Neely began his keynote address with a phrase saying, “Vulnerabilities are great, resilience varies and adaptations are unavoidable and necessary.” He gave a brief introduction about the adaptations and resilience and the various factors related to them. He also mentioned that resilience can be increased by better planning and policies. While explaining his study, he mentioned that South Asia is the most climatic vulnerable area and later he described various adaptive measures that should be taken for decision making in coastal areas that require more attention and protection. He also pointed out to the fact that 20 years from now water shortage is going to be 40% greater. Challenges of adaptation increase with growing population. Human induced climate change happens to be a new challenge. Society is capable of planning adaptation. He also highlighted the need for a further education of people through media. The poor and marginalized has always been targeted and is always at a greater risk. Further, the ability of the ecosystem to adapt to climate change is restricted by the phenomenon of urbanization. Our exploitation of ground water has resulted in the decrease of the water table. He also pointed out to the threat to surface water in coastal areas as sea level rises. Agriculture is more vulnerable to impacts of climate change and methods of preserving water resources should be devised. He concluded by saying that water deserves all the attention as it is critical to all human endeavors. We need to strengthen regional and international cooperation. Technology and science should be efficiently used.

Mr. P G Dhar Chakrabarti gave a brief introduction about the global, national and regional trends of various forms of natural disaster such as Hydro-meteorological disaster (floods, hurricanes & droughts etc), Geological

disaster (earth quake etc.) & Biological disaster and their statistic. On the basis of available 110-year disaster statistics and his research, he mentioned that the percentage of hydro-meteorological disasters is the maximum, amounting to 76.4%. He also talked about the methodology of climate change risk assessment the major uncertainties, which occur in assessing the impact of climate change on natural disasters.

Mr. Patrick Yadauga an economist and businessman represented the views of corporate sector and spoke about stewardship of water from a business point of view. He also emphasized the concept of product integrity and meaningful protection of environment. He began with some statistics and graphs, forecasting water demand and stress in India for the coming few decades, the learning derived from it and carried on to discussing the importance of strategy and tactics and specific performance targets. He explained that the goal at Coca Cola, India has been to become water neutral. Currently, the company is 82% water neutral and the next step is to become water positive in the year 2011, focusing on safe drinking water, sanitation and harmonious relations with communities.

Dr Krishna Kumar presented “an assessment of the impacts of climate variability and climate change on India’s monsoonal climate”. The question in consideration was whether climate change is impacting the food and water security of a monsoon dominated country like India. He explained how urban expansion is occurring at the cost of agricultural land – a cause of global warming and how our croplands and crop productions are getting affected by it. Later he talked about the epochal pattern of all India summer monsoon rainfall and the expected future changes in rainfall and temperature over India under IPCC SRES AIB GHG scenarios. Assessing the



impacts of watershed management was also discussed. Fluctuation of the monsoon pattern since the last 140 years was also brought to notice.

Dr Arabinda Mishra discussed about the adaptations to climate change impacts on India's water resources. He explained why ecology is important in planned adaptations and how to deal with its uncertainties. He also mentioned about the adaptation measures for India's water resources under different climate types.

Dr Eddy Moors talked about changing water availability, attributing it to change in glacier melt and the changing monsoon pattern. He laid emphasis on climate change and supported his views with a regional climate model of India. The model had been derived through the downscaling of a global climate model. Dr Moors shed light on other factors such as socio economic changes affecting land-water use and inadequate and inefficient use of water in agriculture leading to less productivity.

Dr Mats Eriksson addressed the issue of water vulnerability in the context of agriculture. According to him, the rapid increase in undernourishment in the past few years is a consequence of "differences in areas in food supply", which in turn is a result of dry spells caused by variability in rainfall. He drew a cause and effect relationship between global warming and the declining productivity of rainfed agriculture. Dr Eriksson suggested that there is a need to reduce food waste as food production consumes water. He gave a figure of 179 kg/capita/yr for the food wasted in the EU. He also suggested that in order to adapt to the changes in climate farmers

and end users must be provided with meteorological and hydrological data in readable format.

Mr Krunal Negandhi gave a presentation on the planned hill city of Lavasa located in the Sahyadri range and built in the catchment area of a dam. He stated that the city has been built keeping in mind the ecology of the region with great emphasis on water conservation by integrating rainwater-harvesting techniques in the city's plan. According to his presentation, although water is not scarce in the city, but management of water is important as rainfall is highly variable across the area, the maximum rainfall reaching 5000mm.

Deliberations

The discussions in the session revolved around water vulnerability as reflected in changing patterns in nature, such as climate change, changing trend of natural disasters, rainfall and temperature distribution, in context of the Indian sub-continent. The attempts being made to develop resilience to these changes and the challenges faced in process of planning adaptation were discussed. How much investment is required and how much is justified was considered to be important. One common opinion throughout the session was that India's agricultural sector, the largest consumer of water, relies heavily on monsoon for its supply. Since the speakers were from diverse backgrounds, many aspects of the issues related were covered ranging from hydrological modeling, agriculture and food supply to water conservation in business and industry and the planned city of Lavasa.



SESSION - 3

REGIONAL WATER SECURITY, RESOURCE USE AND ALLOCATION





The session focused on the challenges in water resource use and allocation in view of the increasing water scarcity and regional water stress combined with the prospective risks of climate change. Discussions provided insights to various scenarios on competing water demand amongst the agriculture, industry and domestic sectors. It highlighted the mechanisms and prospects on water use, allocation and sharing in different hydro-geological regimes. Some of the issues proposed for deliberation during the session included:

- The present and prospective scenarios of water stress in the global and regional perspective in light of changing climate.
- The existing coping mechanisms for the competing water demand amongst various sectors.
- The challenges and benefits through joint management of trans-boundary water resources.
- The mechanisms for optimal use and allocation of water resources in river basin systems.

This session was chaired by **Mr. Suresh Prabhu, Ex Minister for Water Resources**. Speakers that addressed the audience included

- **Dr. Andreas Schild**, Director General, International Centre for Integrated Mountain Development (ICIMOD), Nepal
- **Mr. Q K Ahmad**, Founder and PKSF Chairman, Bangladesh Unnayan Parishad, Dhaka
- **Dr. Dipak Gyawali**, Nepal Water Conservation Foundation and Former Minister Water Resources
- **Prof. Damia Barcelo**, Head, Environmental Chemistry Department, University of Portsmouth, Barcelona, Spain

- **Dr. Abdin Mohd. Ali Salih**, Profesor, Faculty of Engineering, University of Khartoum, Sudan
- **Mr. Tim Kasten**, United Nations Environment Programme (UNEP), Switzerland
- **Mr. Mark Smith**, Director, Global Water Programme, International Union for Conservation of Nature (IUCN), Switzerland

Interventions

Dr. Andreas Schild started his keynote address with the discussion on regional water security with respect to the Indus, Ganges and Brahmaputra Basins since they form part of three countries and the associated challenges; one of them being upstream-downstream factors governing relationships between countries. He further added that the management issues have to be undertaken by the states whereas funding could be provided by the government. He further mentioned that the northward movement of the monsoon, melting and expanding of glaciers, role of Westerlies and aerosols, particularly black carbon, signifies the nonlinear characteristics of Climate Change. Based on the latest research he further stated “Snow and glacier melt in the months of April and May, due to black carbon is four times more than the greenhouse effect”. He emphasized the need for a differentiated package of decentralized, autonomous and planned measures in which involvement of all stakeholders is required. He also said that the solutions call for upstream-downstream cooperation, for example Early warning systems and Flood information systems etc. Few more strategies include rainwater harvesting, groundwater recharge and a new approach to watershed management. He concluded by saying that investment in mountains is essential and



that mountain ecosystem services must be evaluated in details.

Following Dr. Schild, **Mr. Q K Ahmad** addressed the session on “Food security in South Asia”. He started by stating that “Water is critical and food security and climate change is making it more critical”. He threw light on the importance of domestic production and its associated problems like land quality degradation due to monoculture and indiscriminate use of chemical fertilizers, water scarcity in many areas and the increase in energy demand for irrigation purposes. He emphasized that future depends on our adaptation to all of the adverse scenarios and advancing human capabilities, as is being done by India. Basin management of rivers via flood management, electricity generation and trade would also benefit multiple nations. He said that the best measure to ensure food security is by “eradication of poverty and not just the reduction”. He believed that laboratories should be set up on the ground, rather than in policy making rooms. He concluded that despite the global efforts being made for example the SAARC Food Bank, each country should have a long term food security plan.

Dr. Dipak Gyawali started by comparing the “National water policies” to the “Rain in Colorado”, which never hits the ground and gets evaporated midway. He discussed the two aspects of ensuring water security being the Implementation of Governmental Policies and the ground level reality. He stated that there is too much ‘Eagle Eye’ Science and very little ‘Toad’s Eye’ science and both are necessary for ensuring water security. He further added that under the current scenario, Eagle Eye Science lacks roots while Toad’s Eye Science lacks a

broader perspective. He noted that the Himalayas are Water Towers, not because of their snow cover but because of rich underground water. He enlightened the audience by saying that no work has been done on Spring Hydrology so far and much of our water security plans need to come from the understanding of the springs. He concluded that governments, activists, hydro-geologists, community organizations and common people need to work in sync rather than a single minded perspective. Thus the answer to the water security issues is “Many 10% solutions”!

Prof. Damia Barcelo addressed the session on challenges with water allocation, coping with water scarcity in the Iberian/ Mediterranean rivers. He broadly categorized the potential alternatives for facing water security into provisioning additional water resources and promoting water saving and efficient use. The former being Technology driven and latter being Ecosystems driven. The challenges faced today include improving predictability in water security, refining the scale, connecting factors affecting water security and connecting relevant actors. He identified the actors as technical solutions, water quality management, societal requirements, water resource management and freshwater ecosystem conservation. He concluded by briefing the audience about his project “Assessing and predicting effects on water quantity and quality in Iberian rivers caused by global change” wherein multiple stressors and scales using multidisciplinary approaches will be incorporated.

Dr. Abdin Mohd. Ali Salih started by categorizing the Global Water consumption as Agriculture 70 %,



Industry 22 % and Domestic 8 %. He enlightened the audience with UNESCO's contribution to sustainably respond to regional and global changes in water resources. Then he summarized the journey of UNESCO starting with ideas in 1948, to the Major Project of Arid Zones in the 1950th, to the International Hydrological Decade (IHD: 1965-1974), and the International Hydrological Programme (IHP: 1975 to date). He also spoke about two cross cutting IHP programmes, FRIEND (Flow Regime for International Experimental and Network Data) and HELP (Hydrology for Environment, Life and Policy). He concluded by introducing the audience to G-WADI i.e. water and development Information for Arid Lands (A global network), of which India is an important part of.

Mr. Tim Kasten started his presentation by revealing few facts to the audience like in the next 25 years Ethiopia, India, Kenya, Nigeria and Peru are most likely to run short of water. The Indus river basin is expected to be at 830 cubic meters per capita per year which is less than

half of what is considered to be upper water stress limit of 1700 cubic meters per capita per year. He distinctly brought out the concept of shared Water, Responsibility, Benefits, Resource and thus proposed an ecosystem approach to climate change. He stated that "Natural Ecosystems don't recognize politics" hence to derive services from them and be a regular receiver of them we need to manage them as one unit. Thus he threw light on importance of restoration of ecosystems by saying that biodiversity is a key component of ecosystem health and also that the cost benefit ratio to maintain ecosystems is not always unfavorable. He enlightened by saying that 145 trans- boundary water agreements are already in place and opportunities are rising for more. He concluded that in order to follow an ecosystem driven approach political treaties, trans- boundary level agreements, investments at upstream stations by downstream etc., need to be employed.

Mr. Mark Smith began his interventions with a statement "Water is complex and the hydrologies are shifting" and in order to solve such a complexity there is a need to consider multiple and independent goals. He further added that climate change is shifting the hydrology all the more. He suggested three building blocks to build water security which are flow management, sharing benefits equitably from community to trans-boundary levels and to build resilience in practice. He stated that much of the progress comes from building around the process rather than evidence collection. He concluded that in lieu of shifting hydrologies the water security may be ensured by managing complexity and building resilience, building cooperation from community to trans-boundary through benefit sharing.



SESSION - 4

CLIMATE CHANGE IMPACT ON NATURAL WATER SYSTEMS





Climate change will continue to have a significant impact on water resources, particularly in the South Asian region, by virtue of its influence on natural water systems and the hydrological cycle. This session focused on various components of natural water systems like melting glaciers and their influence on river flow patterns, rainfall variability and impacts on monsoon system affecting water availability and sea level rise. The discussions deliberated on existing capacities, limitations and knowledge gaps in modeling and prediction scenarios.

- The current and future scenarios of climate predictions and variability in different hydro-geological systems and the downscaled scenarios in the region.
- Current status of glaciers in the region and their influence on the river basins and flows.
- Developments and bottlenecks in the science of climate predictions and the options available to address them.

The panel was chaired by **Dr. Prodipto Ghosh, Distinguished Fellow, TERI**, which consisted of following distinguished experts:

- **Mr. A.K. Bajaj** Central Water Commission, Ministry of Water Resources
- **Dr R Krishnan** Centre for Climate Change Research, IITM
- **Dr Chandan Mahanta** Civil Engineering Dept., IIT-Guwahati
- **Dr. Mandira Shrestha** ICIMOD, Nepal
- **Dr. Shresth Tayal** Water Resources Division, TERI
- **Dr. Prateek Sharma** Dean, Faculty of Applied Science, TERI University

Interventions

In his opening remarks, **Dr. Prodipto Ghosh** briefed on the impacts of climate change on water-resources and water-modeling. He also addressed the issues related to impact of climate change on natural water systems such as melting glaciers, changing monsoon pattern, water related natural disasters, etc. He also talked about policy making task which is going to be more complex when we address the question of climate change particularly with respect to human being behaviour, human settlement patterns and patterns of economic behavior. He also addressed the issue about coastal impact due to sea level rise.

The key note address was delivered by **Mr. A.K. Bajaj**, who gave a comprehensive view of prevailing water conditions in India as well as the various institutes working on it. He discussed the likely impacts of climate change and said that climate change affects livelihood of people and all the facets in life and ecology. Intensification of the hydrological cycle affects a number of sectors like agriculture, industry, hydropower etc; and the condition is more severe in developing countries especially with agrarian ecosystems like India. He discussed the highly uneven availability of water resources in India. He emphasized it by saying that less than 1700 cubic meter/capita/year water is available in water resources in India. He further gave a statistical distribution of water utilization and its future demand in various sectors across the country. He also spoke about the National Action Plan on Climate Change, launched on 30th June 2008, under which the National Water Mission was formulated.



He detailed its goals and the development of the Water Resources Information System (WRIS). He gave a brief introduction about the study on different basins in India, their quality and quantity management and the various efforts made by government organizations, NGOs and institutes.

Dr R Krishnan (Centre for Climate Change Research, IITM): Dr Krishnan began with an overview of the long term and short term hydrological impacts due to climate change. He addressed the issue of variability in monsoon due to climate change and explained the relevance of earth system modeling to improve monsoon predictions. He said that South Asian monsoon was full of uncertainties, and these must be covered in the simulation model, making it a challenging process. The significance of modeling lies in identifying attributions of regional monsoon climate and projections for future. He talked about the influence of aerosols on weather conditions and cloud formation which in turn affect the monsoon. He also emphasized the need of capacity building and research in understanding the affects of climate change on monsoons and precipitation in general.

Dr Chandan Mahanta (Civil Engineering Dept., IIT-Guwahati): The water resources in the Himalayas were the focus in this part of the session. Dr Chandan pointed that one single model is not enough to model the climate of Himalayas as the climatic conditions vary greatly across this area. But it is an important ecological system as more than six mega rivers originate in this part and flow to different areas. For example, the glacial lake in Bhutan is important in terms of possibility of glacial outburst. Such disasters could lead to decreased water availability leading to decreased reliability of

hydropower production. He presented some models of river basins and said that we needed improved regional models for future projections. The Brahmaputra model suggested a shift in the bank line due to erosion and flooding. He stressed the need for regional modeling in order to plan appropriate mitigation and adaptation measures that must be sustainable in the long term. He concluded by comparing the modeling scenarios with Lorenz's butterfly effect highlighting the sensitive dependence of the outcome on initial conditions, just as the flapping of wings of a butterfly in Brazil may lead to a tornado in Texas.

Dr. Mandira Shrestha addressed the problems faced by the people living in Hindu – Kush Himalayas (HKH). HKH is the youngest geologic formation and fragile ecological environment. She mentioned about increased occurrence of floods and other extreme events and the study which reveals that globally there has been an increase in flood disasters and the affected are largely the poor people, primarily women, children, and elders. She spoke about the structural measures, non-structural measures (such as modeling, mapping and flood-proofing) and flood forecasting and warning system. She talked about the regional flood information system under development (HKH-HYCOS) and the importance of “*making information travels faster than flood*” in flood disaster mitigation. She summarized her presentation on spatial distribution of average precipitation of Nepal (2003-06) using geospatial stream flow model. She also spoke on the role of ICIMOD in flood risk reduction and the problems and challenges relating to flood risk reduction. She cited trans-boundary sharing of real time data as an important measure in mitigation efforts.



Dr. Shresth Tayal presented on “Multiple Vulnerability forciers to high altitude hydrological patterns”. He began by explaining the phenomenon of water cycle in nature and sub-cycle relating to the replenishment of glaciers. He focused on long-lived, short-lived and natural vulnerability forciers. He summarized the technical details of TERI’s triplet approach (Phase I), explaining the methodology from glacier monitoring to run-off modelling.

Dr. Prateek Sharma gave a conceptual framework on the factors incorporated in flood analysis. He mentioned that most hydrological-infrastructure designs are made on the basis of flood analysis. He gave a brief introduction about the various sectors like water resource engineering, water supply engineering, highway engineering etc where flood studies are relevant. He also talked about spillway design flood and standard project design (SPF). Brief discussions were also made on return period (recurrence interval) and probability, statistical distribution models, methodology for model identification, frequency curve

developed by using model, trends in flood flows, types of climatic patterns like ENSO, Pacific Decadal Oscillation (PDO) and etc. He concluded by mentioning the various problems to be addressed in water management due to climate change impacts.

Deliberations

In the question & answer session, the panelist tried to explain most of the queries raised by the audience on the importance of trans-boundary sharing of real time data, especially in the event of a flood, for basins that spread out on both sides of a national boundary like the Hindu Kush - Himalayan basin. With reference to better water management practices and policy formation, the need for involvement of stakeholders and end-users of water was highlighted. Irrigation (and therefore, agricultural) policies, modeling approaches, and early-warning systems for floods were also briefly discussed in the interaction with the audience.



SESSION - 5

WATER QUALITY AND HEALTH





Water contamination due to geo-genic and anthropogenic sources continues to be one of the critical challenges adversely affecting the natural ecosystems, agriculture, human health and productivity. Climate change is anticipated to exacerbate the prevailing pressures on water quality and availability through salinization, aquifer depletion and disrupted flows. The objective of this session was to discuss and share experiences on the current status and issues that pose substantial risk to the water quality and human health in the region. The deliberations considered the solutions to address the gaps and barriers responsible for deteriorating water quality and health. Some of the key questions intended to be investigated during the session and derive feedback on includes

- What are challenges to improve water quality in natural systems (surface and groundwater), agriculture and drinking water supply?
- What are the emerging challenges and concerns on water borne diseases affecting human health and productivity?
- What is the current level of understanding about the linkages of climate change on human health?
- What are the R&D gaps and constraints that need to be prioritised to identify and address water quality challenges?
- What are the recent global approaches/best practices towards tackling the geo-genic and anthropogenic contamination of water resources?

The session was Chaired by **Mr. Arun Kumar Misra, IAS, Secretary, Department of Drinking Water and Sanitation, Ministry of Rural Development, Government of India.**

The discussion revolved around challenges, concerns to improve water quality (both surface and ground water), water borne diseases affecting human health and productivity, linkages of climate change and human health and global approaches to tackle the geo-genic and anthropogenic contamination of water resources. The speakers of this session were

- **Mr. Ravi Narayanan**, Vice Chair, Asia Pacific Water Forum, Advisor, Centre for Public Health and Equity, Bangalore, Advisor, Arghiyam
- **Dr. P K Mehrotra**, Director, Water Quality Division, FPARP and IEC division in Ministry of Water Resources, GoI
- **J.S.Kamyotra**, Member Secretary, CPCB
- **J.S.Thakur**, National Professional Officer Non Communicable Diseases and Mental Health, WHO Country Office, India
- **Dr.M.J.M.Kujiper**, Geohydrologist, Deltares, The Netherlands
- **Mr. Y V Rama Rao**, Scientist, Indian Meteorological Department, New Delhi

Interventions

At the start of the session, the chair person Mr. Arun K Misra highlighted that death through diarrhea represents 11% of the deaths among children under five years. Lack of access to safe drinking water inadequate sanitation and poor nutrition all have attributed towards the same, he added. He requested the forum and the session in particular to address and sensitize the issue of water quality and its impacts on health.

Mr. Ravi Naryanan, the first key note speaker in this session categorized water quality issues into three



areas namely challenges, dilemmas and choices. The challenges highlighted as:

1. Defining the boundary of debate which earlier revolved around water quantity, reliability of water sources and supply of water while water quality emerged as a major topic of debate in recent times.
2. Issues of temporal spread of hazard identification. – The major concern varied from Arsenic in 1980s to fluoride and more recently nitrate contamination and presence of heavy metals and radioactive elements in drinking water sources.
3. Water Source Diversity- Ground water getting polluted by geo-genic and anthropogenic sources and surface water getting polluted by mainly pesticide runoff from agricultural lands and industrial pollutant discharge.

The dilemmas raised were:

- 1) Whether water should be treated at the consumer end or point of supply. Public stand pose a big challenge while arguing for treatment at point of use.
- 2) Multiplicity of problems has been another dilemma. Even if one attempts to approach the issue there are questions such as accountability and responsibility for public health that arise.
- 3) Fragmented nature of Millennium Development Targets. These have been taken as water targets and sanitation targets but never together as water and sanitation targets. Unless taken together, the entire gamut of issues related to this sector cannot be tackled.

The choices put forward were:

- 1) Cost considerations for water treatment. If two sources of supply exists (piped water source for bulk

water and another for drinking water) the trade off between improved health and increased costs needs to be derived.

- 2) Decentralization of water treatment. Whether this is an impelling for impeding factor when it comes to quality. At the Panchayat level it would mean not only a burden in terms of reliability and ensuring water security as well as public health.
- 3) Legalization of water quality as a human right. If water as a human right comes into force in the country as endorsed in the General Assembly declaration it would have various legislative implications such centre state share of responsibilities and that of the Panchayati Raj Institutions etc.

He concluded stating that the nine issues put forward under the broad heads of challenges, dilemmas and choices pertinent to the system framework of water quality issues and health.

Mr. Mehrotra commenced stating that ground water is the way of life and not just a commodity. The dependency on ground water for agriculture and domestic usage in most parts of South-east Asia is very high. He concentrated on the issue of rising pollution in ground water and its impact on drinking water supplies and health. Ground water is now getting deteriorated in terms of increased salinity, fluoride concentration and presence of heavy metals which can be attributed to geo-genic processes like saline water intrusion into coastal aquifers and also due to anthropogenic processes. A detailed report has been published by the Central Ground Water Board (CGWB) in 2010 where various hotspots have been identified. He also provided statistical estimates of number of districts affected by chemical



pollutants and approximate number of people affected including health effects for each pollutant. The deterioration in ground water quality is mainly due to the over exploitation, intensive agriculture that demands the use of pesticides and fertilizers and other human activities.

Salinity has become an issue of concern. Various parts of the country particularly western India is becoming heavily saline on account of various human activities. 137 districts of India are affected by salinity. 203 districts are affected with excessive fluoride. 206 districts are affected by iron. 36 districts are affected by arsenic.

Radio active elements like Uranium and Radon have been identified recently as latest addition to the pollutants. He suggested a measure to improve the quality by artificial ground water recharge to dilute the pollutant concentration. He talked about active participation of private parties in monitoring and innovation of new technologies for treatment of water quality. He concluded with the quote **“As water is everybody’s concern, let everybody participate in it.”**

J.S.Kamyotra also started with the importance of water. He threw light on the extent of rain water that is unused and the over exploitation of ground water. However the issues of concern with respect to health are water quality. In this regard, he listed two fundamental concerns for human health as 1) Accessibility of water and 2) Quality of water.

If we do not have accessibility to water supply or water then it is a cause of major concern to health. Quality of water is also of fundamental concern. Drawing reference to the data of 2002, he stated that 2.5 billion persons

were reporting illness on account of contaminated water. 50% of these illnesses in the developing countries are from water borne diseases. Five million people die from the same. He threw light on the linkage of water usage and quality of water. Water quality standards vary depending on the use of water. For drinking water, the quality standards are high however it changes in context of water required for industrial and agricultural purposes.

He also dealt with five broad categories (A, B, C, D & E) for water usage based on water quality parameters such as organic pollutant loads, pH content, Chemical oxygen Demand etc. Rapid population growth and economic development is leading to a number of issues in India due to the uncontrolled growth of urbanization. The waste water generated in class one and two cities is around 38000 million litres but the treatment capacities here is only 12000 million liters which means that only 31% is treated. Indiscriminate disposal Municipal Solid Wastes, hazardous wastes, biomedical wastes etc have also contributed to contamination of ground water. CPCB has established network of monitoring stations located over rivers, lakes, reservoirs, wells etc to assess the impact of the same.

He concluded with the concept of 5Rs that were listed as 1) Reduce 2) Reuse 3) Recover 4) Recycle and 5) Recharge, as a measure to resolve the problems related to water. In context to water Recharge or rejuvenation of the water bodies is extremely important since it will be of immense use for saving the resources.

J.S.Thakur (National Professional Officer Non Communicable Diseases and Mental Health, WHO Country Office, India):

He discussed about water borne diseases and its linkage to water pollution. Poor water quality has continued to pose threat on human health. One of the major water borne disease is diarrhea which alone accounts for 4.1% of the total world's diseases responsible for death of around 1.8 million people a year. It has been estimated that 88% of the burden is attributed to water supply, sanitation and hygiene. In the context of India, diarrhea caused due to unsafe water and inadequate sanitation followed by pneumonia is the most common cause of death among children below 5 years. Adverse health outcomes are associated with ingestion of unsafe water, and poor sanitation in India causing around 7.5% of the total deaths in the year 2002.

A study as a part of Water and Sanitation Program's (WSP's) Global Economics of Sanitation Initiative suggest that the total economic impacts of inadequate sanitation in India amounts to Rs. 2.44 trillion (US\$53.8 billion) which was the equivalent of 6.4 percent of India's GDP in the year 2006.

Water related diseases may be defined as any significant and widespread adverse shaft on human health such as death, brief illness disability, or disorders caused directly or indirectly by the conditions or changes in the quality of water. He also detailed various sources of pollutants in urban and rural context. He categorized the contaminants into microbiological and chemical sources. These include viral, bacterial, parasitic and protozoal infections. Chemical contamination such as fluoride, nitrate, heavy metals such as chromium cadmium etc in water also leads to adverse health impacts.

He further discussed the relation between the health disorders and water pollutants based on two case studies carried out by W.H.O. One such studies conducted by W.H.O in the Malwa region of Punjab found high incidence of cancer due to higher levels of heavy metals in drinking water. Similarly another study commissioned in Punjab to investigate the common health issues of the population living along the major water basins as compared to those areas that were less polluted. This study threw light on health impacts on account of polluted water mainly due to industrial pollution and pollution caused by indiscriminate use of pesticides.

He concluded that the implementation of stringent laws and water management plans are required to address the issues of water quality.

Dr.M.J.M.Kujiper started with the description of the influence of agriculture and human waste pollution and drinking water quality in rural India. She detailed the "Barefoot Hydrologist" Project initiated by Dutch organizations and implemented with support of Gramvikas in Orissa which has addressed the safety and security of drinking water in the state of Orissa. The areas of research work are mainly hot water areas, sea coast and also some zonal areas. The water quality in these villages were not tested before. The project aimed at providing clean and sufficient water for drinking, washing and bathing. Local communities had no knowledge of linkage between sanitation and water quality.

As a part of this project barefoot hydrologists were trained to test water. Training of local people on usage of water monitoring toolkits was a part of the implementation. The studies in Orrisa brought out that nitrates and micro biological contents were high in the water. Various sessions were organized for orientation of farmers, bare foot hydrologists and the local population. Wherever contamination was detected necessary steps were planned strategically.

She also shared the community level projects implemented successfully in Netherlands, Aruba and Saudi Arabia. She stressed upon the fact that training of local communities will not only help in improved awareness but also reduce anthropogenic pollution. She concluded saying **"Do not focus on treatment when you can prevent pollution in the first place"**.

Mr. Y V Rama Rao, also made a brief presentation on the functioning of IMD in terms of weather forecasting. He provided insights on the role of IMD to study the dynamic water resources of the country thus enabling farmers to combat natural calamities (flood, Droughts) by enhancing early warning systems. He also briefed on data generated and disseminated through web services in addition to internet based enquires and publications that are available for use.

Deliberations

A question was raised on the problem of water quality in Bundelkhand region. To this Dr. A K Mishra, responded that water conservation programs should be taken up on war footing basis and ensure steps for sustainability. A couple of queries were raised on the super bug and whether additional chlorination



was a means of purification to address the same. It was responded that chlorination is indeed a start up measure to address the issue. Another similar question was raised on having proactive programs (since various parameters re not within the list of those tested on a routine basis) possible contamination. In agreement to this question, the chair responded stating that the Central Ground Water Board may include some more parameters for testing.

Another question that was raised was on the water quality monitoring kits provided to the Panchayats and if these are working and being used. Water quality has been

tested in many villages and the results of the same have been uploaded on the website: www.ddws.nic.in.

The session was concluded with the chair person stressing on awareness generation and education at the grassroots level. Four major issues that were not addressed in the session and require attention were listed as;

- 1) Strict enforcement of laws
- 2) Water quality standards for India.
- 3) Regulation of excessive ground water exploitation.
- 4) An integrated and multi sectoral approach involving government, private and civil society.





SESSION - 6

RURAL WATER SUPPLY AND SANITATION





Food security in the developing nations across the globe is a major challenge. It is a complex phenomenon which comprises of range of factors from access to utilization of the food products. The session tried to identify the key challenges in managing water for food security and specifically deliberate on regional disparities in crop-water productivities as also the trade dimensions of food and water security. It had discussions on regional perspectives on water governance for food security including the following key questions

- What are the known implications of impacts of climate change on agricultural water security in the river basins of South Asian region?
- What are the innovations and mechanisms to enhance crop productivity under prospective climate change scenarios?
- How the current water and food policies are ensuring 'food for all' in South Asia?

The session was chaired by **Dr S. S. Meenakshi Sundaram**, Vice chairman, India WASH Forum **Panelists:**

- Mr T.M Vijay Bhaskar, Joint Secretary, Dept of Drinking water and Sanitation, Ministry of Rural Development, Govt. of India.
- Dr Joe Madiath, Founder and Executive Director, Gram Vikas, Orissa
- Dr Aidan Cronin, Water and Environmental Sanitation specialist, UNICEF
- Ms Nafisa Barot, Executive Director, Utthan, Gujarat
- Mr Rakesh Johri, Senior fellow, The Energy and Resources Institute
- Ms Abha Bahadur, Sr Vice President, Sulab International Social Services Organisation

- Mr Vikas Chawla, Vice President, FBO, Hindustan Coca-Cola Beverages Pvt. Ltd (HCCBPL)

In his opening remarks Dr Sundaram emphasized on the need to concentrate on finding solutions rather than highlighting the problem and in replicating the success stories.

Mr T.M Vijay Bhaskar during his presentation emphasized on the new guidelines of the department and salient features of the presentation included special provisions like 5% fund diverted to software activity, 22% for SC and 10% for ST. He mentioned that 4.6 million people still do not have access to safe water supply, 28% habitations are partially covered with pipe supply. The main blockades are poor O & M (operation and maintenance), high cost and lack of continuous coverage and support. He emphasized on training the village community for barefoot hydrological assessment and making decisions to balance the water in their region. He also focused on empowering the local community to manage their own drinking water system. He talked about water quality issues especially ground water contamination due to chemicals and bacteria. For that, institutional mechanisms have been set up at state, district and block level including 27 national key resource centers for continuous training. He concluded by pointing out that the *major problem is not the mindset of people but the poverty* which compels them.

Dr Madiath expressed that his most important concern and passion was **sanitation**. He mentioned that according to the WHO, 80% of diseases, especially in rural areas are caused due to poor water quality and neglect toward disposal of human feces. In India and



other developing countries human feces enter drinking and bathing water sources which is the foremost cause for several diseases.

Speaking on the need for genuine sanitation in India, he said that *dignified solutions must be offered to the people*, so as to make them more acceptable. Another issue that he highlighted was separate departments for water and sanitation in states of India. Due to which many times a toilet scheme is implemented much before the water supply to that toilet is planned. This leads to an additional burden, especially on the women, since in order to ensure functioning and hygiene of these toilets, water must be fetched from far away. He concluded by saying that in order *to achieve total sanitation, subsidies must be provided not only to the people below poverty line (BPL), but to other communities as well.*

Dr Aidan Cronin stated on a positive note that India had achieved sanitation targets to a certain extent and should make use of the findings to accelerate and prioritization of sanitation. With regard to the *Millennium Development Goals (MDGs) for water supply, the progress is significant but security and safety issues are still persistent.* Highlighting an vital finding about water quality, he informed the audience that the health threat from contaminants such as Arsenic is much lower compared to the threat from bacteriological contamination such as fecal coliform. He suggested that one way to deal with the persistent water issues would be to create demand and ownership at village level. This would enable us to reach remote pockets and scale up the quality. However provision of quantity is not enough, quality also needs to be considered. He also added Within that, one challenge would be to make the local people appreciate the values

of the system and to solve this, they must take ownership and maintain water resources themselves. Dr. Cronin also talked about need for communication, security and safety issues. He concluded by suggesting that quality services need to be strengthened and political commitment needs to be generated.

Dr. (Ms) Nafisa Barot started her presentation by saying that water issues are to be kept alive as they have not yet gone away. She then continued by suggesting that work must begin with vulnerable communities and that the thrust area was livelihood enhancement and gender sensitization. She shared her experience from the Bhal region (Gujarat) where there were barrages but not water which resulted in about 80% migration away from the region. She also stated that shortage of water supply can lead to violence, which was why men were not included in the task for collecting water, and the burden fell to the women of the region. Water supply had other basic issues as well since some tail end villages were connected with pipes but has no water in them due to leakages throughout the pipe's length. Also, there were instances where resources had been re-diverted for commercial uses, industry and agriculture. Dr. Barot said that *prominent issues of health, hygiene, dignity and privacy were coupled with a strong gender demand for toilets and bathing facilities.* Other issues that were highlighted by her included the absence of acts to ensure drinking water and lack of legislation, policy and subsidies equitable distribution.

Mr. Rakesh Johri related to the audience, his personal experiences in villages of Tamil Nadu and Uttarakhand. He stated that fundamental cause for water and sanitation related issues was poverty. Recalling his



experiences from the Economics of Sanitation project in the states of Orissa, Haryana and Uttar Pradesh, he stated that all sample villages in the state were enthusiastic to have improved sanitation options setup in their communities. He said that the major reason why implementation of toilets and sanitation facilities in rural areas fails is due to the impractical and inefficient way in which they are setup. He supported this claim with examples such as certain toilets which were setup outside the village area were hardly used due to the distance. In another situation, as few as 10 toilets were installed for a community of 100 or more people. Land ownership also poses to be problem since users in rented houses cannot construct their own toilets. Col. Johri also reiterated that the quality of construction in rural areas is very poor and that water and sanitation must be tackled as a whole. He concluded by suggesting certain measures such as ***better monitoring of these systems so as to provide a 'true picture' of the harsh realities of water and sanitation at the ground level.***

Ms Abha Bahadur giving an overview of global sanitation and hygiene statistics, stated that 2.6 Billion people have no access to sanitation in the world and about 1.1 billion people resort to open defecation. During 2001 21.9% of the population had access to sanitation and accessibility has improved significantly up to 57% in 2008.. The challenges in rural areas as outlined by Ms. Bahadur were ***socio cultural factors such as taboos in having toilets within houses, lack of awareness and illiteracy.*** She reinforced what many speakers had stated before that women in villages had higher privacy needs than the men population and that the lack of toilets in schools was primarily hampering the education of girls in rural India. She spoke about the need for more sustainable design of toilets that would save more water and also reduce GHGs. She concluded her presentation by citing examples of how her organization had brought about a transformation in society and had empowered the lower classes with by giving them a dignified livelihood option. They had also overcome many social taboos by involving NGOs in total social mobilization for rural upliftment along with women.

Mr Vikas Chawla said that “water is the new oil”

but also hoped that its state, in the near future, would not be the same as it is for oil today. He linked that to the important issues of sanitation by saying that sanitation is a critical challenge in 21st century. He spoke about how expectations from business have evolved over the years and that corporations today are open minded and enthusiastic about corporate social responsibility. As an example, he referred to the 35% reduction in water usage that Coca-Cola Beverages had achieved in a short period of time. He gave examples of how the company has worked to implement water and sanitation projects in West Bengal, Bangladesh and Sri Lanka. Also mentioned the significant work done in creating awareness, via education and training of employees. He also stated that Coca-Cola has installed 200 drip irrigation projects in KalaDera region in Jaipur, Rajasthan. They also built 600 rain water harvesting structure, separate toilets in schools and check dams in Dharamsala. He highlighted Coca Cola’s most recent endeavor, in partnership with NDTV, ‘Support my school campagin’, which is aimed at bringing proper sanitation to a 100 schools in rural areas in India. He concluded his by saying ***“working together can secure a better future for water and sanitation in villages”.***

Session Concluding remarks by Chair Person

Chairperson stated there are two things that came out of this session- in respect of drinking water supply people are aware of the need the issues are largely on accessibility quality and sustainability. Then in the case of sanitation creating demand is major problem and to see that we take the people along and make it as demand driven program rather than keeping it as supply oriented.

The question of convergence general quality these are things which are cutting across work water supply and sanitation which we need to deal with. To conclude the solutions have to be decentralized and we have to find solutions which will suit the need of particular place. With this I am grateful for all the panel speakers.

I am also grateful to two presenters from the grass root level – SULABH and COCA COLA explaining to us what they are doing in this direction. I conclude this session and thank you all.



SESSION - 7

WATER AND FOOD SECURITY





Food security in the developing nations across the globe is a major challenge. It is a complex phenomenon which comprises of range of factors from access to utilization of the food products. The session will identify the key challenges in managing water for food security and specifically deliberate on regional disparities in crop-water productivities as also the trade dimensions of food and water security. It would enable discussion on regional perspectives on water governance for food security including the following key questions

- What are the known implications of impacts of climate change on agricultural water security in the river basins of South Asian region?
- What are the innovations and mechanisms to enhance crop productivity under prospective climate change scenarios?
- How the current water and food policies are ensuring 'food for all' in South Asia?

The session on Water Aid and Food Security was chaired by **Mr. T. Nanada Kumar**, Former Agricultural Secretary, Member, National Disaster Management Authority (NDMA).

Rising global temperatures will lead to an intensification of the hydrological cycle, resulting in dryer dry seasons and wetter rainy seasons, and subsequently heightened risks of more extreme and frequent floods and drought. Changing climate will also have significant impacts on the availability of water and also lead to declining crop yields. The session revolved around the challenges of food security as an impact of climate change and the policy interventions for addressing the same.

The speakers of this session were

- Mr. Q.K. Ahmad, Founder & PKSF Chairman, Bangladesh Unnayan Parishad, Dhaka
- Dr. K. Santosh Deshmukh, Jain Irrigation Systems Limited, Jalgaon, Maharashtra
- Dr. Sharad Kumar Jain, NEEPCO Chair Professor, Department of Water Resources Development & Management, IIT-Roorkee
- Dr. Paul McShane, Chief Scientific Officer, Monash Sustainability Institute, Monash University, Melbourne, Australia

Interventions

Mr. Q.K. Ahmad, in his key note speech stressed upon the need for ensuring food security both at national level and micro level. Drawing on the FAO (2002) definition of food security, he stated that access to good quality and sufficient food for every individual irrespective of socio-economic demographics is the vital. He stressed on sufficient domestic food production at country level. When compared to other countries of South Asia, India is a net food exporter while other countries are not. Food security and rural livelihoods are intrinsically linked to water availability and use. An increase in per capita income has led to a change in the consumption pattern especially of those who can afford. Meat and fish consumption has increased thereby putting additional pressure on water resources. A number of south Asian countries already experience considerable water stress as a result of insufficient and unreliable rainfall, changing rainfall patterns or flooding. The impacts of climate change including predicted increases in extremes are likely to add to this stress, leading to additional pressure on water availability, accessibility, supply and demand.



In addition farming areas in many of these regions are in the semi arid regions and hence further susceptible to climate change

Drawing from his work experience with the IPCC, he stated that climate change poses a massive threat to humanity and global community mainly through its impact on agriculture and food security particularly in south Asia for various reasons. He also discussed on how changing weather patterns and climate change can affect the food productivity and quality. These changes and uncertainties have further complicated food security issues leading to more problems like poverty, unemployment etc.

He called upon for an integrated approach for tackling this issue. Since food security is intrinsically linked to water. Climate change has an impact on precipitation, on the rainfall, increasing frequency and intensity of droughts, sea level rise leading to saline water intrusion etc. Hence in the face of climate change and food security, improved water management is essential for adaptation. In a larger context management of the basin wide approach for rivers will benefit countries optimally. Eradication of poverty is another measure of tackling food security. Institutional and governance reforms are also required to balance demand and supply this requires reorientation of socio economic policies at various levels.

Dr. K. Santosh Deshmukh, discussed climate change- food - water - energy security nexus and its interlinkage. Given the current economic situation of many water-stressed countries, demand is equally important as reducing water consumption and improving water use efficiency. In the Indian scenario, 70% of water is being used for irrigation. With the rising population

and climate change posing additional pressure on food security, there is a need for increasing water productivity by promoting efficient irrigation in agriculture.

He called upon for implementation of modern irrigation systems like drip and sprinkler as a mitigation measure to overcome the problem. The positive impact of drip irrigation system on overall efficiency of crop production was also detailed through the studies carried out at Jain irrigation. Around 120 agronomists across India have been working with farmers in their fields to save water by 70 -80%. Many small farmers have also been able to achieve food security. The percentage increase in yield per hectare is a clear indication of water saving and food security. If the farmers

Drip irrigation leads to increased crop yield, efficient usage of water thereby addressing problems related to energy security, water security, food security as well as rural to urban migration in the global climate change and population-resources imbalance scenario. Drip irrigation system if well maintained can be put to use for a minimum of 20 years the failure is generally less than one year. Drip irrigation also has a tremendous impact in terms of reduction of Green House Gas emission.

He concluded that technology such as the drip irrigation can provide solutions to energy security, food security, water security as well as deal with rural-urban migration and also deal with climate change issues thus aiming to bring about a change in the poverty scenario

Dr. Sharad Kumar Jain, introduced the concept of Virtual Water which is a measure of indirect consumption of water resources in the form of agricultural products and other goods. Virtual Water he elaborated stating has three components namely green, blue and grey



components. The green and blue components comprise of water consumed and the grey component is the polluted water. He also shared the results of his study on Virtual Water trade among the states through food grains (rice and wheat) in India. The objective of the study was to estimate the movement of virtual water among states. Analysis of data from 1999-2000 to 2006-07 highlighted huge disparity among states in production of food grains and that rainfall in the largest exporter states is much less than that in the importing states.

Virtual water flow dynamics is also controlled by access to arable land than access to freshwater. Thus water alone is not the sole governing factor (subsidized energy also plays an important role).

He concluded that land availability and productivity, infrastructure to support agricultural activities, land reforms, farmers' entrepreneurship, and rural credit

system are the key factors that impact crop production.

Dr. Paul McShane touched upon developing integrated catchment management strategies for sustainable water use in response to climate change. He stressed upon approaches which should address user-friendly integrated models and knowledge management systems for coordinating information exchange among agencies and stakeholders. Case study on Ganga and Mahanadi river basin brought out the structural and functional contexts involved in knowledge management. He concluded that harnessing collaborative capability across relevant disciplines, developing specific research proposals to address knowledge gaps, building a regional research network with climate change focus and developing reliable systemic models would serve the purpose.





S E S S I O N - 8

SUSTAINABLE CITIES, WATER SUPPLY AND DISTRIBUTION





This session will focus on the impacts of climate change on cities with a focus on equitable access and sustained delivery of urban services in water supply and distribution. The session shall also showcase some of the successful innovations from various cities for sustainable water management, and highlight the policy and institutional drivers that enable effective service delivery. Some of the issues to be deliberated include

- How is climate change likely to impact the quality and delivery of urban services?
- What are the current efforts by city governments to promote sustainability and build climate resilience in terms of management of water resources?
- Given the financial, technical and institutional constraints what are the additional policy entry points that can be leveraged?
- What are the possible measures to improve water efficiency through water conservation and demand management?
- What are some best practices from cities for water management and effective service delivery that could be models for replication?

The session was chaired by Dr. J. R. Sharma, Group Director, WRG, National Remote Sensing Centre, Hyderabad and interventions were made by following distinguished panelists:

- **Mr. Navin Kumar**, Secretary, Ministry of Urban Development, Government of India
- **Dr Anamika Barua**, Assistant Professor, IIT-Guwahati, Assam
- **Dr Cornelis Ary Bons**, Subsurface and Groundwater Systems Department, Deltares, Utrecht, The Netherlands

- **Mr. Mohit Bhutani**, Hindustan Constructions Company
- **Dr Vishal Narain**, Public and Policy Management, Management Development Institute, Gurgaon
- **Mr. Anshuman**, Water Resources & Policy Management, TERI
- **Dr. Madhusudan Dhananjay Chaudhari**, Jain Irrigation Systems Limited, Maharashtra)

In his keynote address, **Mr. Navin Kumar**, mentioned about the challenges being faced by the urban regions in India due to increasing population as well as internal migration from rural area to urban cities. Mr. Navin talked about Government of India's commitment to assist the state's urban local bodies in building and maintaining sustainable water supply. He highlighted the government's policies like Jawaharlal Nehru Urban National Water Mission and Urban Infrastructural Development scheme for small and medium towns. He stressed that the need of the hour is to implement strategies like demand side management reduction in water distribution losses, water economic and auditing – water quality energy efficiency and water efficiency, water safety plan and water technology – appliances and Public Private Partnerships in safety water management in water supply. The way forward in improving urban water supply is not only to invest in additional infrastructural capacity but in with the management improvement in its quality, quantity availability and accessibility. He also iterated that there is an urgent need to develop technical and managerial skills in urban water supply system in order to address the challenge. There is also need to involve the private sector in a major role in order to take advantage of their



ability- to bring about efficiency in operation- and also ensure better service to the customers. This would intend to development of regulatory mechanisms which would provide comfort. Mr. Navin was pleased to appreciate the states like Maharashtra and Chhattisgarh, which have already moved ahead by establishing regulators in bulk water sector and municipal water sector supply system.

Dr Anamika Barua assisted by her PhD student, Mr. Pronoy Rai, presented the difficult situation of water supply in the city of Guwahati, Assam. The main source of water is surface water, from River Brahmaputra. "There is no physical scarcity of water in the city". However problems arise because of improper and poor distribution. Dr Barua emphasized on the problems of demand and supply gaps, the division between the poor and the rich in terms of water availability and the gap between infrastructural availability and actual supply, stating that the current population is around 12 lakh which is expected to reach 30 lakh in less than 20 years. Due to inadequate supply by the three water utility services, people of Guwahati heavily rely on private companies, which provide tankers, catering to 30% of the population. Others rely on ground water, which itself is under the threat of iron and arsenic contamination. There is a water deficit of nearly 11 MLD in the city. A survey, which was part of the study, aimed at households brought out few important findings. One was that huge amount of investments that is being made by high-income groups in filtration of the water (installation of water filtration facilities at home) and due to lack of resources it was not possible by the low-income groups. However, both groups were equally willing to pay for water supply. There was heavy reliance on private water supply. In order to meet

with the demand and potable water distribution, Assam Water Supply and Sewerage Board AWSSB is in talks to procure land for pre-sediment plan, soft loans are being given and under JNNURM a grant of Rs 280 crore is provided. According to Dr Barua there is a need to unify the efforts of the three water utility providers of the city.

Dr Cornelis Ary Bons highlighted the fragmented nature of water institutions in most countries and the efforts of the government of the Netherlands to unify a number of institutions to work together. He speaking about urban flood vulnerability, citing the floods in Jakarta as an example and explained that apart from climate change there could be other reasons too behind urban floods. The city of Jakarta, Indonesia, experienced floods in 2007 due to land subsidence caused by continuous ground water extraction over years to meet with the water demand. In some areas land had subsided by more than 1m. He attributed the flood to the 20-year tidal cycle. With this example he pointed that there are many changes happening in the world; there is no solution to these changes, including the climate change and the water problem; what is important is that we respond to these in an adept manner. He spoke on structural adaptation measures (SAM) as well as non-structural adaptation measures (NSAM). Structural adaptation measures refer to the constructed pipelines and other structures built to reduce risk. Talking about structural measures, he added that we must understand design condition and be prepared for situations wherein the threshold is exceeded. He further added that we need to strengthen threshold capacity, coping capacity, recovery capacity and adaptive capacity, and added that all these measures require participation of public and stakeholders. Towards



the end he commented, “There are many dangers in the world; what is important that we create development that takes care of the environmental dangers”.

Mr. Mohit Bhutani spoke about the HCC CEO Water Mandate – a voluntary initiative by business leaders in partnership with international community and the six areas of UN CEO WM in direct operations, supply chain and watershed management, collective action, public policy, community engagement and transparency. As an endorser, HCC submitted its first “Communication of progress” (COP) report on 30th Sept 2009 and second COP on 30th Sept 2010 as an annual submission of its report to UN on its progress of implementation of six areas of the mandate. He mentioned that HINCON HOUSE: HCC’s Corporate Office, established by the US Green Building Council (USGBC) and verified by IGBC in Sep 2009 has achieved LEED-Gold Certification. Then he also mentioned the following projects of HCC:

- 1) Badarpur Elevated Highway Project, involves construction of 4.4 km elevated highway on Delhi Agra section of NH-2, helped in 7906 cubic meters of rain water harvesting & wastewater reuse..
- 2) Middle Vaitarna Pipeline Project, based on reuse of Hydro-testing Water for two consecutive section of pipeline and helped in 1557 KL of Wastewater Reuse.
- 3) Vizag Cavern Project, India’s first strategic crude oil storage at Vishakhapatnam, Andhra Pradesh, and recycled 6 lakhs liters of tunnel wastewater/ day.
- 4) Maroshi Ruparel Tunnel Project, helped in reuse of

547 KL / year of tunnel wastewater.

In concluding remarks, he also mentioned about the awareness campaigns and the implementation of rainwater harvesting systems in water scarce areas like Kihim Village of Maharashtra by HCC, which recharges 211 cubic meters of water.

Dr Vishal Narain presented on water security in peri-urban areas. Explaining Peri-urban areas stated with three different perspectives- as a place, as a process and as a concept. These are areas where the rural and the urban co-exist, and can be seen as a transition from the former to the latter. He explained that the complicated situation in these areas, with regard to changing pattern of consumption, mixed and changing land use, social heterogeneity leading to water insecurity. As stated by him, water insecurity is closely linked with land insecurity, which is very much prevalent in these areas undergoing change of policies along with urbanization. ***The ongoing urbanization has put natural resources in these areas under stress and scant attention in terms of policy and planning is paid to them as peri-urban areas are caught in the dichotomy of rural development and urban planning.*** Their issues can be addressed neither through a rural nor an urban approach. Cities around Delhi such as Noida, Gurgaon and Faridabad fall under this category. In these places, for example in Gurgaon, residents get inadequate supply of water and the tubewells have dried too, due to which they are resorting to other solution such as using wastewater to irrigate. Through his



presentation, Dr Narain brought to everyone's attention that peri-urban areas require special attention to deal with water supply and management.

Mr. Anshuman emphasized on major water issues across the country such as water stress, per capita availability of water, and urban water supply etc. He addressed inequitable access to water as a major problem in urban water supply. Across the country, the percentage of the total population, which lack access, to water in urban and in rural areas is 10% and 26.8% respectively. There is a high disparity in per capita water supply due to which water use becomes unsustainable and inefficient. He also discussed about irrigational tariff and said that not much money behind supplying water gets recovered. He showed his studies on water demand management in four cities – Indore, Jabalpur, Gwalior and Bhopal. He said water demand management needs a paradigm tool. Two things that need to be focused on are how much water is pumped into the system and how much is going to the consumers. Water Demand Management is integrated with other plans too for the implementation of policies and measures to control and manage water demands in cities. He gave an example of Madhya Pradesh and said that water resource availability is not a problem there but the problem is how to access it. While explaining his case study on Bhopal, he mentioned about the methodology of water resource model and also about the water losses as between 22-43% in that area. He also briefly mentioned the Financial Performance appraisal of Bhopal Municipal Corporation. He concluded the session by mentioning

the strategies e.g. water metering, water auditing, leakage detection and control, and transition from cash based system to double entry system that should be adopted for water demand management

Dr. Madhusudan Dhananjay Chaudhari (Dr Chaudhari addressed present water supply scenario as unsustainable due to irregularity, leakages, intermittent, possibility of contamination, low supply pressure, free of cost/ per month fixed cost, tendency of public to waste more water and maintenance (which results in stoppage of water supply for an entire ward). He spoke about 24*7 continuous water supply system as safe, reliable, affordable, sustainable and successful. He described the features and functioning of HDEP (High Density Poly Ethylene) pipes. HDEP pipes are available in coil, have less joints and joints are monolithic, hence provide leakage proof and contamination free water supply. They also assure corrosion free water availability. These pipes have long life of approximately 100 years. HDEP pipes are easy for taking connections, house service connections, and are unaffected by the acidic or alkaline state of soil (pH 2 – 14). He also mentioned the advantages of HDEP pipes on technical context. HDEP pipes have 1600mm of diameter and 1700 tonnes of weight per pipeline and Jain Irrigation Systems Ltd is its only manufacturer in India. He shared the experience of Jain Irrigation Systems Ltd while establishing 24*7 water supply system in Hubli, Dharnad, Gulbarga and Belgaum cities of Karnataka (2008). 2200 house service connections were made and the work was completed within 2 years. Water



consumption in these areas got reduced by 40-50%, operation and maintenance cost got reduced by 30-40 %, revenues were increased by 4-6 times and it was a safe and corrosion free water supply. During presentation he also mentioned that on 13th August 2009 the company has been awarded by the Hon'ble President of India for "The Best Water Infrastructure Project in India". The company also has on-going projects in Thane, Navi Mumbai, Shikaripura Tamil Nadu and Balh Valley.

In **Panel discussion**, Mr. Navin Kumar, Mr. Anshuman and Dr. Vishal Narain spoke about the funds

and the schemes related to water resources. It was mentioned that earlier the schemes for water resources were used to be run by public funds but now urban sector is growing at a faster rate; hence only public funds aren't enough and participation of private sector is also required. JNNURM has an objective to use its funds for private schemes, maintenance and quality management of resources. And to maintain a balance between demands and supply management, government organizations, NGOs and institutions should make efforts to bring users and providers on a common platform.





S E S S I O N - 9

SCIENCE AND TECHNOLOGY CHALLENGES FOR WATER SECURITY





Application of science and technology in improving water use efficiency has a major role in complementing the efforts to ensure water security of a region. This session highlighted the latest technological developments and innovations in tackling water contamination, improving water use efficiency and water conservation. It also explored the avenues of technological interventions needed to respond to challenges in water security. Some of the issues to be deliberated include

- What are the available options for effective technological intervention to improve water use efficiency?
- What are the innovations and constraints in development of cost effective technologies?
- What role can science and technology play in improving the water security of the region?

The session was chaired by Mr. **T. Ramasami**, IAS, Secretary, Department of Science and Technology, Government of India. Talks by following eminent personalities provided great insights into the recent advances in applying scientific and technological knowledge to water resource management.

- **Dr. J. R. Sharma**, National Remote Sensing Centre, Hyderabad,
- **Dr. V.C. Goyal**, National Institute of Hydrology, Roorkee,
- **Dr. Ashok Chapagain**, World Wildlife Fund, UK,
- **Mr. Phillipe De Taxis Du Poët**, First Counsellor, Head of Science and Technology, Delegation of European Union to India
- **Dr. Fergal Whyte**, Global Water Business Leader, ARUP, Hong kong

- **Dr. Jon MacDonagh-Dumler**, Institute of Water Resource, Michigan State University

Interventions

The keynote address was delivered by **Dr. J. R. Sharma**. He spoke about the far-reaching project that he is currently spearheading, called the Water Resource Information System (WRIS) launched under the joint collaboration of Central Water Commission (CWC) and Indian Space Research Organization (ISRO). He envisioned this resource as a “single window” for all water related data, which could be customized to the needs of individual users; he added that it would be able to incorporate multiple inputs, such as climate change scenarios and different hydrological models. He emphasized the importance of adequate, accurate, consistent and dynamic real time data availability for better planning and management of water resources. He also highlighted the importance of technologies like GIS and Remote Sensing. Major outcomes of the project include an increase in transparency and quality of data by geo-visualisation, information systems and area-specific user services, such as maps of individual watersheds. He further emphasized the need for capacity building and proposed providing Digital Watershed Atlas, in 3D, by December. He concluded by reiterating the fact that one of the first steps towards a better understanding and management of India’s water resources will be to have access to information and data about it. This project aims to collate and provide that information to researchers.

The next talk by **Dr. V.C. Goyal** focused on the three aspects of water management that influence water security – water supply, water quality, and climate change



impacts. He focused his talk on the role of technological interventions in addressing the three challenges, and gave relevant examples to better illustrate his points. He said that the main challenge faced in the realm of water supply today is the spatial and temporal variance in availability of water. He suggested better supply and demand side management with examples of each. Supply side management could include technological interventions such as dams, interlinking of rivers, and other irrigation projects. Demand side interventions could include improved irrigations efficiencies, crop diversification, and improving water use efficiency using various measures. He focused his presentation on the ways in which specific technological interventions could help achieve water security. He cautioned professionals working in this field to never ignore the economic impacts of water projects, and to always remember that every project has potential impacts on the livelihoods of people.

Dr. Ashok Chapagain talked about water footprints and virtual water. Virtual water is the water embodied in produced goods. Countries that are dependent on importing goods with large water footprints are also, in effect, dependent on water resources in other parts of the world. Water has become a geopolitical resource, like oil. Accounting for virtual water resources, one can see how countries are put at risk. An example is of asparagus in the UK, which comes largely from Peru. Asparagus farms in water scarce areas in Peru cause severe ground water depletion, in which the UK both deserves some blame and also shares some of the risk. Conversely, trade from

water rich to water scarce areas can help *conserve* water. Among the solutions suggested were need for innovative government water policy and managing the size of one's national water footprint.

Dr. Phillippe De Taxis Du Poët gave an overview of the collaborative activities between India and Europe in the form of the European Union Research Programme. 54 billion euro is allocated for the programme, out of which 2 billion euro are for water related activities. Dr. Poet emphasized the need for coordinated research and funding for water challenges and security.

Dr. Fergal Whyte presented a few case studies that illustrate local solutions to some of the problems of water security in the world today. The examples included an urban rainwater harvesting project in Southern Australia which included aquifer recharge, a desalination plant in Australia, rehabilitation of pipe networks in the





Philippines, and recycled water use for landscaping in Hong Kong.

Dr. Jon MacDonagh-Dumler talked about reconciling advancements in scientific knowledge with applications at the local level. He presented a groundwater assessment tool that was developed by his group at Michigan State University which allows for local users to use advancements in groundwater modeling.

Deliberations

The audience asked questions on a wide range of topics from desalination technologies in India – their popularity, funding sources, and their energy uses, to questions on the methodology used for calculating water footprints of products such as T shirts. Members of the audience also asked about access to the WRIS database.





SESSION - 10

POLICY, GOVERNANCE AND REGULATORY FRAMEWORK





Effective governance and responsive policies are of paramount importance in defining the course of sustainable water management. The issue of governance is multidimensional and a holistic institutional framework that encompasses the social, economic, political, and legal structures is essential. Developing an appropriate and responsive policy framework for governance is essential for ensuring water sustainability and adaptability to climate change. Some of the issues deliberated include

- To understand the policy implications of climate change and identify measures for innovative adaptive governance that reduces vulnerability and increases capacity.
- To emphasize the significance of mechanisms like climate-centric development, mainstreaming climate change into institutional reforms and strategic development activities.
- To recommend renewed policy priorities in response to water security under changing climate.

Introduction

This session was chaired by **Prof. Ramasway Iyer**, Honorary Professor, Centre for Policy Research (CPR). Following eminent personalities provided great insights and led to a though provoking discussion which greatly engaged the audience.

- **Dr. Mihir Shah**, Member, Planning Commission of India
- **Mr. Ajit M. Nimbalkar**, Chairman, Maharashtra Water Resources Regulatory Authority
- **Dr. Iskander Abdullaev**, Transboundary Water Management in Central Asia, Regional Advisor, GIZ, GmBH, Uzbekistan

- **Dr. Tushar Shah**, Senior Fellow, International Water Management Institute
- **Dr. Manish Kumar**, IAS, Secretary, GoI

Interventions

The keynote address was delivered by **Dr. Mihir Shah**. He described the paradigm shift in the Planning Commission's policies towards formulating an integrated action plan for sustainable water resource management. He observed that most of the government initiatives are not actually getting implemented for providing water at the grass roots level. He stressed the importance of reform in filling gaps in existing infrastructure using innovative management rather than expanding infrastructure mindlessly. He called for forming a regulatory framework with legal liabilities and an independent commission to check for compliances to environmental and investment clearances for all existing water infrastructure. He also opined that an integrated approach is required for aquifer mapping and management involving local stakeholders along with government agencies.

In his talk **Mr. Ajit M. Nimbalkar** shared the success story of a Water Regulatory Authority that was created to improve accountability, transparency and involvement of all stakeholders in the management of water resources in the state of Maharashtra. He described in detail the activities of the regulatory authority which included clearance of projects, setting of tariffs and entitlement programs. He also stressed the importance of metering so that accurate imposition of tariffs and losses of water can be accounted for. He concluded by saying that acceptance is needed for such independent regulatory authorities by



the political system, and that the establishment of such authorities will lead to better management of our national resources.

Dr. Iskandar Abdullaev, talked about Water Management in Central Asia which is an outcome of an interaction of the local, national and interstate issues. He emphasized the importance of institutional and technological innovations in effective water management. He stated that water control should be at all three levels of water management: local, state and regional level. At the local level, collective action and rules for inclusion; at the state level, comprehensive national water strategies that can take care of adaptation to climate change and at the regional level, political negotiations and legal framework agreements for water sharing and strengthening of regional institutions would be of great help.

Dr. Tushar Shah, focused his talk on proactive ground water management that can stabilize agriculture, curtail the carbon footprint of water, revitalize the energy economy and provide for a healthy groundwater ecology. He discussed the role of irrigation in the context of climate change and its effects on ground water. He called for better management using the advantages of intensive and responsible aquifer management. He concluded by sharing the statistical details of success story of the state of Gujarat which led to the replenishment and ensured the sustainability of its groundwater.

Dr. Manish Kumar, discussed the regulatory challenges of Public-Private Partnerships (PPP) in water supply. Regulation is critical because water supply is essential to life, it is a politically sensitive subject, and there exists a natural monopoly. It is promoted

by government for strengthening infrastructure. He discussed the shortcomings of the current urban water supply system. He emphasized the need to involve private sector in domains and functions that were traditionally considered sovereign. He finally concluded by discussing the regulatory definitions and challenges faced while implementing PPP projects and suggested a few methods by which they could be overcome.

Deliberations

The audience asked questions on a wide range of topics including questioning the need for additional institutions when so many already exist, and perhaps the problem is inadequate communication and collaboration between them. Other discussions included ways in which the government can participate in ensuring an equitable usage of water supplies, particularly between urban, peri-urban, and rural areas.





SPECIAL SESSIONS

STAKEHOLDER DIALOGUE ON WATER USE
EFFICIENCY IN THE INDIAN CORPORATE SECTOR



INDO-GERMAN ROUNDTABLE ON 'WATER, CLIMATE
CHANGE, AND CONFLICT IN SOUTH ASIA'





SPECIAL EVENT

STAKEHOLDER DIALOGUE ON WATER USE EFFICIENCY IN THE INDIAN CORPORATE SECTOR

The ‘Stakeholder Dialogue for Water Use Efficiency in the Indian Corporate Sector’ was organized as a special event at the India Water Forum 2011, in collaboration with TERI-Business Council for Sustainable Development (BCSD). The event was organized with the motive of sensitizing all stakeholders of the Indian corporate sector about improving water use efficiencies in businesses.

The water sector in India faces major challenges with declining per capita water availability and stands stressed with rising water demand, mainly from the already competing agriculture, domestic, and industrial sectors. Projected water requirements for various sectors of Indian industries show that the water requirement would almost double from about 15.2 BCM in 1997 to 32.2 BCM in 2010 and is expected to increase seven fold to 102 BCM by 2050 (Indiastat.com, Central Water Commission 2008). While on one hand, industrial water demand shall increase, on the other hand it will face fierce competition for the resource with other sectors, such as irrigation, energy, and drinking water. The Government of India, in its National Water Mission (NWM) under the National Action Plan on Climate Change (NAPCC 2008) has proposed to develop a framework for optimizing water use efficiency by 20% through regulatory mechanisms with differential entitlements and pricing. This would require various sectors, including industries to optimize their water use practices, ensuring efficient water use, water conservation, recycle, and reuse.

The amount of water used by the Indian industries for production is quite high (about 15 BCM) as compared to

many countries, such as Argentina (2.6 BCM), Brazil (9.9 BCM), Korean republic (2.6 BCM), Norway (1.4 BCM), Sweden (0.8 BCM), and UK (0.7 BCM). The ratio of water consumption and economic value creation is close to \$ 7.5, which is very low, compared to these countries. As ‘industry’ is already found lowest in order of water allocation priority in the National Water Policy, and intensifying competition from other stakeholders for this limited resource will only increase in the future, it is clear that a sustained supply of freshwater will become an increasingly critical issue for the survival of many industries.

Given these challenges, the concept for efficient water management needs to take centre stage in business planning by the corporates.

WATER AUDIT AND ACCOUNTING

The contemporary approach of typical ‘end-of-pipe’ treatment of industrial wastewater needs to shift towards decentralized, process integrated water management with efforts towards ‘zero discharge’ or ‘positive water balance’, thus, reducing the fresh water consumption as well as pollution. This requires comprehensive information about the quantity and quality of water being used (and/or wasted) at different stages of the industrial processes. The first step towards this is the identification and measurement of the flows, water quality, and losses within different stages of the system through regular water audits. Although there is growing realization amongst Indian corporates for efficient water management, there is also a need for sensitization of different industries on the concept of water audit and its benefits.

Water audit helps in development of an integrated industrial water management strategy, which optimizes efficient use of water, improves water productivity, reduces losses, and helps in identifying alternative methods of water conservation, such as recycling and reuse of wastewater for various process and non-process uses, rainwater harvesting, and groundwater recharge. The activities ensure co-benefits in energy saving, treatment costs, water quality improvement, and so on.

TERI with its experience in the water audit field provides support for building capacity of interested organizations, industries, and government officials. TERI has undertaken several studies on water auditing of various industries and has helped them identify losses in the system and opportunities for improving efficiency and water conservation, including recycling, reusing, harvesting, and recharge. Through its water audits in the city water supply system, TERI has helped the local municipal corporations in identifying the unaccounted for water (UFW) and provided them different short- and long-term strategies on the technical, institutional, and financial management of the water supply system.

The session on Water Audit at the Stakeholder Dialogue on 14 April 2011 is aimed at sensitizing the participants to the concepts of water auditing and its benefits through identification and prioritization of areas of water conservation and management, given the challenges of process inefficiencies, depleting groundwater tables, rise in price of water, and climate change. With this background, the basic aim proposed for the forum was to address the following objectives:

- Enable corporates to demonstrate their leadership in water conservation efforts through audits, which will reduce costs for water supplies, electric power for pumping, and thereby increase the profit of industries.
- Enhance knowledge of corporates and industries on benefits of water audit and their ability to use it as a tool for improving water use efficiency and conservation in their operations.

INDIA WATER TOOL: OPPORTUNITY TO BE INVOLVED

TERI-BCSD India member companies brought out a White Paper on the Corporate Action Plan on Climate Change (championed by GMR Group-Delhi International Airport (P) Ltd; HSBC India; Intel Technology India Pvt.

Ltd; and Oil and Natural Gas Corporation Ltd), to define the new opportunities presented by India's National Action Plan on Climate Change (NAPCC). In the second phase of this exercise, TERI-BCSD India's focus is now to successfully convert the white paper into sector-specific activities and programmes, which would herald India Inc.'s commitment to address climate change.

Taking cognizance of the National Water Mission, TERI-BCSD India aims to develop a tool specifically for Corporate India—the India Water Tool (IWT), which will help to assess water sensitivities in site areas across the country. The datasets within the tool will be detailed and India-specific information on water availability and usage will be incorporated. This exercise will be undertaken in collaboration with World Business Council for Sustainable Development (WBCSD). In 2007, WBCSD member companies developed the Global Water Tool. It is acknowledged as one of the best tools to assess corporate water-related risks at a global level. It is endorsed by GRI and over 300 companies have used it to date. It can be accessed here: www.wbcds.org/web/watertool.htm

The tool helps companies understand the water sensitivities of areas of existing or potential industry operations. It performs a high-level portfolio assessment of a company's water risks by enabling easy linkage of each location with external water data. The Tool will be a compilation of all available water data from across the country, overlaid together in a confidential, online format. The IWT will have credibility with external stakeholders and will be based on credible and timely data. It will be easy for Indian companies to use it for their operations, their supply chain, or their consumer markets. The IWT will be free for use in the public domain. The creation and use of an India Water Tool will in itself support companies' operations in India, through better understanding of water sensitivities and availability, as well as providing information on potential water risks. Its development will also pave the way for potential watershed-level dialogues that could help promote collective action on shared water risks within different river basins in India.

The event began with a welcome by Pratik Ghosh. The first session was introduced and chaired by Mr. Arun Seth. The two presenters for the session were Mr. Anshuman and Mw. Caroline Twigg.



Mr Anshuman presented TERI's capacity of 'Water Audit and Accounting'. He focused on major challenges that India Inc. would face with the rising water demand and declining per capita water availability. At length he discussed the need for Water Auditing and Accounting and its benefits through identification and prioritization of areas of water conservation and management.

Ms Caroline Twigg presented about 'Managing Water Risks through India Water Tool'. She talked about the water tool essentially as a software that members of the World Business Council for Sustainable Development (WBCSD) developed, which could be valuable for Indian industry if customized. She proposed to work on the India specific tool in collaboration with TERI if companies in India are interested and involved to develop the tool most appropriately. At the end of her presentation she requested all delegates to fill the India Water Tool reply form which would indicate the company's interest in using and promoting the tool

PANEL DISCUSSION

The session after the tea break was a panel discussion moderated by **Mr. Prabir Sen Gupta**, Distinguished Fellow, TERI. The highlight of the Dialogue was the CEO Panel Discussion on the topic "*Water Stewardship: Good for Business-Good for Society*". The eminent panel focused on:

- Thought leadership on how to optimize industrial water use—the cascading approach to water use, from conservation, to reuse, to recycling.
- Practical steps to innovatively use water, whether in the form of new management practices, plant and process changes or installing new technologies.
- Water can no more be relegated only as a corporate social responsibility by the industry and business; it needs to be internalized as an integral part of their core business development.

Some key excerpts from the panel discussion are as follows:

Mr. Asim Parekh, Vice-President – Technical, Coca-Cola present at the deliberations emphasized that businesses had social obligation to think about the societies where the markets are. Water source assessment helps businesses to be efficient as it makes immense business sense to be able to make a quality finished

product by using less water and in the process help the cause of sustainability.

This sentiment was echoed by **Mr. Hariprasad Hegde**, VP and Business Head, Wipro Water, when he emphasized that are operating in an environment of water shortage, which will soon reach a level of water scarcity. A paradigm shift is taking place and solutions like the Global Water Tool as well as government policies can help solve this at the operational level. Water Audit is important as it not only helps in strategizing but demands achievable operational improvement.

Mr R. C. A. Jain, Independent Director, Jain Irrigation, pointed out drip irrigation is a solution to efficient water use in the agriculture industry. On a separate level he emphasized that more than technology, educating the marginal farmers who are in the front line is important. Until and unless that initiative is undertaken the debate on the increasing demand of water in the agriculture sector will continue.

Mr K N Rao, Head - Environment & Energy Conservation Cell, ACC Limited, emphasized that cement industry is highly water and energy intensive industry – from mining to processing, which is aggravated by the fact that most industries are in drylands. Famines in the region can lead to destruction of communities and can result in impacts on manufacturing processes with respect to labor conditions and inefficient operations. Inconsistent power supply has lead to shut down of plants many times. Citing these and many other issues he stressed on the importance water stewardship in industries.

Mr O.N. Bajpai, Senior Consultant, Jaypee Ventures Pvt Ltd JP group, emphasized on the prevalence of inadequate and improper harnessing of water and the importance of storage dams. He put in perspective the ecological concerns that should be kept in mind, but which should not stop development. He deliberated the need to develop sustainable development frameworks.

Mr Manoj K.M. Chaturvedi, Dy. General Manager - CSR-UN Water Mandate, Hindustan Construction Company deliberated that water allocation will be a crucial issue in the future. He also emphasized that allocation of special economic zones will become an issue and industrial competitiveness will be a concern.

The session concluded with a round of question answers after which lunch was served.

SPECIAL EVENT

INDO-GERMAN ROUNDTABLE ON 'WATER, CLIMATE CHANGE, AND CONFLICT IN SOUTH ASIA'



A roundtable on Water, Climate Change and Conflict in South Asia was organized as a special event during India Water Forum 2011. The event was supported by The Federal Foreign Office Germany. The event took place on 14th April 2011 at India Habitat Centre. Realizing the fact that water's trans-boundary nature makes it a geo-political issue, at both the inter-state and international levels. South Asia's large quantity of shared water resources – both in terms of transboundary rivers and groundwater aquifers – makes the region very susceptible to water conflict, while also creating tremendous opportunities for cooperation, TERI invited distinguished guest and speakers for reflection on the current situation. The forum with the deliberations from distinguished panelist and guests explored the issues pertaining to regional water allocation and conflicts. The expert dialogue addressed questions like;

- Q1. How can water conflict be transformed into opportunities for water cooperation? What are some good examples of this transition? Can these models be followed, or is each situation unique?
- Q2. What are the future geopolitical and legal concerns of water rights and right to water?
- Q3. What should be the governance model for resolving water conflict? Is there a role for other mechanisms such as demand-reduction and supply-augmentation? Must all these solutions be multi-lateral, or can states act to implement some of these initiatives in a unilateral manner?

- Q4. What are the likely hot-spots of water conflict in South Asia? What can be done to mitigate the likelihood or extent of these conflicts?
- Q5: What should be the sharing model between the upstream and downstream states? Must these be dealt with on a case-by-case basis, or are there universally applicable principles that apply? Is there a win-win solution to water allocation and sharing arrangements?
- Q6: Should we think differently about intra- versus inter-state water conflicts? What are the different issues at play in each of these scenarios? How do the solutions differ?
- Q7: Will there be policy transition in the future sectoral water allocation principles under the climate change realm and how stakeholder and community initiatives can alleviate conflicts?

Dr. R. K. Pachauri inaugurated the session with his inspiring speech for promoting regional cooperation. Mr. Suresh Prabhu moderated the discussions and he was accompanied by the esteemed delegates like Prof. RamaswamyIyer, Mr. Dennis Tanzler, Dr. Q. K. Ahmad, Dr. AbdullaevIskander, and Mr. Deepak Gyawalion the head table.

Other dignitaries who deliberated upon the issues were Dr. Tushar Shah, Prof Hari Krishna Shrestha, Dr. UttamSinha, Mr. Bishnu Raj Upreti, Dr. ChandaGurung Goodrich, Mr. Ranjan Panda, Ms. Patricia Mukhim, Dr. BajracharyaRoshan Man, Dr S A Kulkarni, Prof



BrijGopal, Dr. JaasveenJairath, Mr. HimanshuThakkar, Mr. Dhirendera Singh, Mr. Crispino Lobo, Dr. Suresh Rohilla, Mr. S. C. Jain, etc.

Chairman reiterating the need for regional cooperation praised the platform provided by TERI to assemble experts of the region under a common roof to discuss on the issue of utmost importance.

Mr. Dennis Tanzler, Senior Project Manager at ADELPHI Germany stated 3 important issues for leading the deliberations, which are as following;

- i. Early warning that means monitoring early warning needs to include particular situations in states of fragility and also needs to focus on tensions over resources on environmental and social economic stress in different regions around the world,
- ii. Enhance international cooperation on the detection and monitoring of the security threats related to climate change,
- iii. Institutional strengthening which means capacity building for crisis management and crisis prevention

Prof. Iyer stressed on the point that climate change is such an issue that it should be dealt by all the countries which are linked together jointly. There should be a joint forum which should actively work in this direction.

Dr. Gayawali reflected upon the fact that how climate change has become a convenient excuse for everything and lack of data sharing between states and countries is a sad state of situation. This should be seriously dealt by the Governments of all the countries.

Dr. Q K Ahmad seconded the opinions of other delegates, and highlighted that each country in South

Asian region has different perspective and approach to manage common resources, which should first be changes and there should be a common ground. This will form basis for working together against climate change.

Dr. IskandarAbdullaev indicated importance of cooperation with Central Asia region as well and especially the country of Afghanistan, who plays upper riparian state for both Central and South Asian region. He cited example of Aral Sea Disaster hinting the poor water resource management. He agreed on the need for regional cooperation especially between upper and lower riparian states.

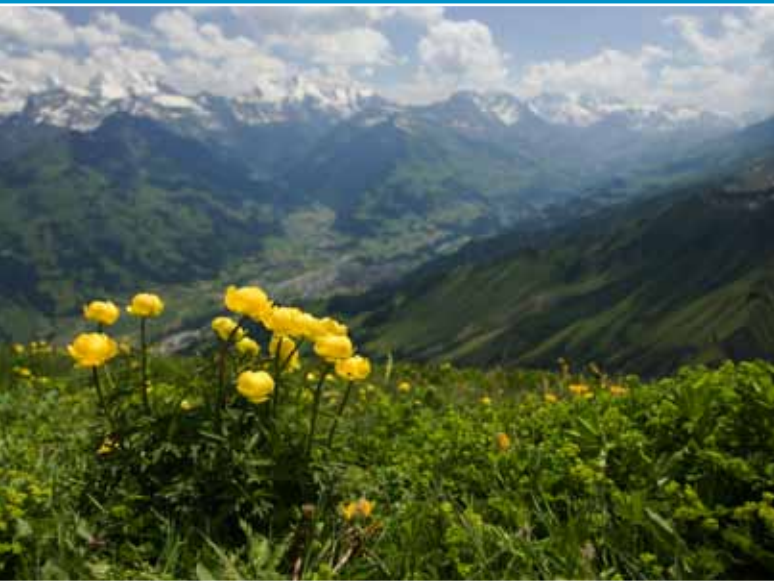
Based on these key speeches, chair opened the floor for discussions, question and answers. All the delegates actively participated in the deliberations. The main outcome was that all of them agreed that there is a strong need for regional cooperation and joint forums and such initiatives as taken by TERI should happen more often so that this can be materialize in reality.

Chairperson ended the session by thanking everyone and gave concluding remarks. He reiterated the problem of lack of data sharing at various levels, and some gaps in the bureaucratic set-up, to which he agreed on the recommendations of other delegates that civil societies should make a push forward. According to him there is only one way we can actually create an institution like SAARC effectively if we can bring about cooperation in water in a very effective manner. He ended the deliberations on a note that all of the delegates can help in materializing the regional cooperation effectively to adapt to climate change especially in water sector.



W A Y F O R W O R D





WAY FORWARD

In South Asia, water is central to economic growth and poverty reduction, due to its significant prominence in the cultural, social, economic and political fabric of the lives of 1.6 billion people, in the region. However, several studies have reported that most countries in South Asia are already water stressed. India with an annual rainfall of about 1170 millimetres (mm), has utilizable water limited to 1123 billion cubic metres (bcm), wherein 61% is contributed by surface water resources. These surface water resources comprising of Himalayan glaciers, rivers, lakes, ponds and streams are under the direct influence of atmospheric circulations, and hence of climate change. With increasing population, urbanization and pollution, the number of stresses on water resources are increasing, leading to the decrease in overall water availability in the region. With the climate change scenarios and their impacts in anvil, these resources need to be preserved while augmenting their capacity simultaneously.

Expert Talks and deliberations during India Water Forum 2011, unanimously stressed that “Climate-proofing” of water resources – in other words, building more resilience to climate change – is very important to be incorporated in the plans and policies related to management of water resources. Moreover, necessary adjustments need to be taken to improve the efficiency of supply, distribution and usage system;

preventing losses from the system and promoting optimum utilization.

While there is no single viable solution available for the entire South Asia, owing to the diversity and complexity of the region, with basic fundamental principles of water resources management adapted to individual river basin dynamics, water availability scenarios can be improved significantly. Based on the views expressed by various academicians, researchers, policy makers, water practitioners, water activists as well as stakeholders like industries, during the India Water Forum 2011, a set of common interventions emerge, which are required to be incorporated in the basic water governance framework of the region, cross-cutting the geopolitical priorities:

POLICY AND GOVERNANCE FRAMEWORK

An adequate policy and governance structure is required to which may blend the concepts of “Water Governance” and “Water Management” under a unified regulatory framework. While it might be premature to move towards harmonization of policies across countries, setting the basis for such harmonization might be within reach, through setting up of identical water management framework in each country.

Moreover, harmonization of competitive demands from various sectoral usages like agriculture, industries as well as domestic, needs to be addressed and this may



be possible through setting up of 'Water Regulatory Committees' at the watershed scale in each river basins, through due representation of different sectors. This demand for a paradigm shift in the approach for water governance - from the state wide to a basin/ watershed wide approach. Coordination committees among the different states as well as upstream and downstream basin regions will also be required to harmonize the water allocation within the basins.

Though an immediate establishment of such a system may not be easy and possible, a foundation may be laid through initiatives in the forthcoming government policies and plans.

KNOWLEDGE MANAGEMENT

An integrated knowledge management centre acting as the repository of all the data and information related to surface as well as ground water resources in each country should be set up. This centre may provide an easy access to all the relevant information required by the researchers across the country.

Also, there exists a large gap between skills available and skills required, both within countries in the region and across them. A fundamental of any water related policy in the region should be to address these shortcomings through training and capacity building, and through partnering with institutions across the

region and abroad to promote the development of a new multidisciplinary generation. Further, widening the knowledge base will involve promoting national and regional initiatives that foster research, develop knowledge and data sharing among institutions, and establish a cooperative framework to advance a regional agenda aimed at increasing the exchange of knowledge and best practices.

USAGE/ HABIT MANAGEMENT

Water is the divine gift from nature to mankind, and access to clean water is a basic human right. However, the significance of water needs to be propagated among users in a way which may ensure the safe return of almost equivalent amount of water used for own survival, back to the nature. Based on this approach, following may be proposed:

INDUSTRIAL SECTOR:

'Water Resource Impact Assessment (WRIA)' need to be made obligatory for the establishment of water intensive industries at the zones with high water stress, identified through analysis of available data. The industries will be required to submit the plan of their water use/ consumption, treatment of effluents and 'Water Return' for future decades of their operation, as a mandatory requirement to receive the clearance for their establishment.



Industrial complexes, already operational and approved for establishment shall submit the report on 'Source Vulnerability Assessment (SVA)' indicating corrective measures to reduce the impacts on water equilibrium in the region of their operation.

AGRICULTURE SECTOR:

Resource constraints in agriculture sector have forced the continuation of preferential treatment of farmers in South Asia in terms of water usage. However, it is pertinent to encourage the users of this sector for optimum utilization of water. For which the schemes promoting the water conservation and minimal irrigational usage like drip and sprinkler irrigation, should be further strengthened and broadened.

DOMESTIC SECTOR:

Group of communities, especially in metropolitan areas like Resident Welfare Association (RWAs), should be made accountable for the return of water usages in the housing society by virtue of Rainwater harvesting and water conservation measures.

Moreover, service and educational establishments like Universities, schools, hospitals and hotels should be brought under the obligatory regime of water conservation and effluent treatment. A capacity of water recharge needs to be augmented by these establishments which are equivalent to their total water usages in their life cycle.

INVESTMENT

- Basin wide Special Purpose vehicles (SPVs) should be established to facilitate the management of financial costs of water usage as well as finances for water infrastructure creation.
- Role of private players in ensuring efficient electricity distribution shall be replicated for the water distribution system as well.
- Financial packages shall be designed as per the river basin, and apportion among the beneficiary states, as per specific schemes.

The critical areas that require immediate investment are the following:

- Water resource management needs to be improved through measures such as adequate training; laying out comprehensive strategies and action plans for extreme events, such as drought and floods; developing new tools, such as modeling, data collection, water allocation schemes, and financing mechanisms; strengthening institutions; and developing a transboundary conscience and regional cooperative framework that leads to actions at that level.
- Water infrastructure packages that can increase water storage capacity require consideration, particularly multipurpose water infrastructure schemes associated



with modernization in specific areas such as agriculture, hydropower, and transport.

- Water-efficient technologies that can better address the adaptation agenda include the latest technologies in water treatment, irrigation dripping, weather forecasting, and monitoring of snow melting and its related impacts.
- Crop research is needed to identify and promote adaptative and water efficient crop varieties and to further the innovative use of (possibly organic) fertilizers to increase agricultural production.
- Education can build and enhance awareness, and can also build constituencies for required behavioral

changes in short- and long-term sustainable water resource management.

TARIFF AND INCENTIVES

Together with ‘consumption slabs’ tariff system, for both the piped water supply as well as privately owned borewells, a system of incentivizing the users engaged in water conservation, through tariff break periods, awards and recognition etc., needs to be established as part of the water regulatory framework. Tax break and subsidy for the appliances, leading to water saving and used in water conservation and harvesting will further promote the practice.



A N N E X T U R E S

CULTURAL EVENT



BIONOTES



SPEECH OF INAUGURAL SESSION



SPONSOR'S PROFILE





CULTURAL EVENT

MUSIC PERFORMANCE (THUMRI)
- MS VIDYA RAO

The cultural extravaganza of the evening began with a Thumri performance by the renowned Ms. Vidya Rao, who is one of the leading performers of the delicate singing style of Thumri-dadra.

She was accompanied by Shri Shanti Bhushan Jha on the Tabla, Shri Vinay Mishra on the Harmonium and Shri Ghulam Ali on the Sarangi. Ms. Vidya Rao gave a brief background of the song and its relevance to the occasion.

Background: Water Bearers

In Indian philosophical and scientific traditions, water is considered to be one of the five elements from which all that exists is formed. In mythology, the watery realms hold secrets and wisdom that only the very brave or the very fortunate are able to access. Himalayan Buddhism too, speaks of the hidden teachings; the iconography often depicts Nagas rising from deep lakes to gift these teachings to true seekers. In a (predominantly) hot country like India, water is a source of life. Indeed one of the words for 'water'—jeevan—also means 'life'.

Water, as elemental tattva is an abstraction. It is when this tattva manifests as rain, or as rivers and oceans, even as tears, that we are able to perceive and relate to it. Indian music abounds with references to these water bearers—rivers, oceans, and rain-bearing clouds. But the water bearer is also represented in the

auspicious form of the woman carrying a brimming pot of water.

The classical repertoire includes many ragas that are associated with rain—ragas of the Malhar family, Megh, Des and so on. These are associated with the rains, are sung during the rainy season and are considered to actually cause rain to fall. Folk music, and its more classicized cousin, Thumri, include several genres such as kajri, saawan, jhoola and so on that are typically sung during the monsoon.

The cultural evening's repertoire drew from the tradition of Thumri, folk songs and medieval bhakti poetry to illustrate the significance of the water bearers in the imagination. The four songs sung during the occasion were the following:

1. **Jaya shree Jamune** in raga Des. Raga des is typically sung during the rains and is one of the 'watery' ragas of the classical repertoire. This song is an invocation to the river Jamuna, on which our city of Delhi is built. The poet, Jugalpriya describes the Jamuna as the one who removes the stain of kali yug (the age through which the world is now passing), and as the beloved of Krishna. Jamuna's banks are home to birds and animals, are fragrant with flowers. The one who bathes in her waters is redeemed and blessed with all auspiciousness and joy. The poet beseeches the river to fill his heart with Krishna bhakti—unbounded devotion to Krishna.

Who would recognize the choked and polluted puddle that the Jamuna is today in this song?

Badra tu jal bhar layo in raga Megh. Megh, meaning cloud, is another raga associated with water. This verse of the 15th century poet, Meera bai addresses the rain-bearing clouds, who seem to signal the arrival of her beloved lord, Krishna. Meera describes the tiny raindrops, the rumble of thunder, the sweet cool breeze, clouds filling the sky, and the song of the koel. Preparing to meet her beloved, adorning a bed for him, singing auspicious songs, Meera says 'Fortunate is the one who attains you'.

Does she mean Krishna, or the rain-bearing dark clouds?

Chalali nahanva. This is a folk song from the Chaiti-ghato tradition of Mirzapur in Uttar Pradesh. Sung during the summer, these songs refer to the fetching of water from the river bank, and often, as here, to the woman going to the river to bathe. This song describes a young woman going to the river to bathe, walking delicately along the path, draped in a red chunari, decorated with the 16 shringar-adornments, a golden pot in her hands. Thus walking, she is waylaid by that flute-player— Krishna and then that is the end of adornment, red chunri and water pot.

Lachakat aave ri in raga Pilu. This is a dadra, one of the genres from the semi-classical repertoire of Thumri. It describes the young panihaarin, the woman fetching water. She walks gracefully, seductively, a pot balanced on her head, anklets on her feet. Smiling, she wins hearts as she goes to fetch water.

The audience thoroughly enjoyed the splendid performance and applauded the performers.

Odissi dance performance by Ms Madhavi Mudgal

The Odissi dance performance by the renowned dancer, Padmashree Madhavi Mudgal and her troupe was very well received by the delegates, sponsors and organizers of the India Water Forum.

Madhavi Mudgal was accompanied by the musicians:

- Shri Jitendra Kumar Swain: Pakhawaj
- Shri Purna Chandra Majhi & Smt Manikuntala Bhowmik : Vocal

- Shri Srinibas Satapathy : Flute
- Shri Yar Mohammad : Sitar
- Shri Diwan Singh : Tanpura

In the Odissi dance performance, she was accompanied by her students Arushi Mudgal, Sudha Mukhopadhyaya, Diya Sen and Snehasini Sahoo. Lighting was taken care of by Shri Gautam Bhattacharya.

The dance performance started with

1. **Ganga Stavan:** The sacred water of the river Ganga was invoked. Ganga - the eternal source of sustenance and rejuvenation, descending from the peaks of the snow-clad Himalayas, through Shiva's matted locks, Ganga playfully cascades down several peaks and mountains to purify the earth. May the sacred waters ever protect and enrich us.
2. **Pallavi:** A joyous display of rhythmic patterns and forms, this piece brought out the architectonics of the Odissi style, through the raga Arabhi. The original solo choreography of Guru Kelucharan Mohapatra was reworked for four dancers. The music was composed by Pandit Bhubaneswar Misra.
3. **Vasant:** An excerpt from the 6th century Sanskrit poet Kalidas' *Ritusamhar*, describing the advent of spring: "The trees are laden with flowers – the ponds are abloom with the lotus – the breeze is heavily scented – the nights are as delightful as the day. O beloved! All beauty is augmented at this time of the year. Young maidens, with love-lorn hearts pierced by the cries of the koels and the humming bees, wander aimlessly. Spring, the warrior, as Cupid incarnate, arrives in all his resplendence, conquering the hearts of all." Music for this piece was by Madhup Mudgal.
4. **Moksha:** According to Upanishadic thought, the ultimate aim of human endeavour is to merge with the Absolute. Towards this end, disciplining the body and the mind, the dancer seeks to concentrate her being into a still point through movement; a state where the individual self is transcended. Moksha is the culmination of the Odissi repertoire.

The spell bound audience gave a standing ovation to the distinguished performance.



BIONOTES

INAUGURAL SESSION



Mr Mohammad Hamid Ansari is the 12th and current Vice President of India. He is a former chairman of the National Commission for Minorities. He is also an academician, a career diplomat, and a former Vice-Chancellor of the Aligarh Muslim University. Mr Ansari started his career as a civil servant in the Indian Foreign Service in 1961. He was Permanent Representative of India to the United Nations, Indian High Commissioner to Australia, and Ambassador to the United Arab Emirates, Afghanistan, Iran, and Saudi Arabia. He was awarded the Padma Shri in 1984. He has authored a book titled Travelling through conflict: essays on the Politics of West Asia. He has written several academic papers and newspaper articles on West Asian politics.



Dr Farooq Abdullah is the Union Minister for New and Renewable Energy in the Government of India. He is best known for his energetic leadership of the path breaking and transformational initiative in renewable energy—The Jawahar Lal Nehru National Solar Mission. He is also known for a number of other initiatives in the renewable energy space in India, notably the introduction of Generation Based Incentives and the move towards introduction of Renewable Energy Certificates. Born in 1937 in Soura on the outskirts of Srinagar, Dr Farooq Abdullah completed his MBBS

from the SMS Medical College, Jaipur. He has had a long and distinguished political career, having served as the Chief Minister of Jammu and Kashmir thrice and a Member of Parliament twice. He has been a member of the Committee on Defence, Member of Parliamentary Forum on Population and Public Health, and a Member of Consultative Committee of the Ministry of Civil Aviation. Dr Abdullah has been conferred the 'Dr B C Roy Award' as a medical man-cum-statesman and D Litt. (Honoris Causa) from Aligarh Muslim University. An ardent golfer, he is keenly interested in photography, classical music, and ghazals. He is also an avid traveller.



Mr Salman Khurshid holds a Bachelor's degree in English and Jurisprudence, a Masters, and BCL and was educated at St Stephen's College, Delhi and St Edmund Hall, Oxford University, Oxford, UK. Mr Khurshid is an advocate and a teacher by profession. He was elected to the 10th Lok Sabha in 1991-96 and held the offices of Union Deputy Minister, Commerce and Union Minister of State, External Affairs during this period. From 1996-97, Mr Khurshid was the Chairman of the Department of Foreign Affairs and during the period 1999-2000 and 2005-08, he served as the President of the Uttar Pradesh Congress Committee. In 2009, he was re-elected to the 15th Lok Sabha (second term) and on 18 Jan 2011, he was appointed Union Minister of State (Independent Charge), Corporate

Affairs; Minority Affairs. Since 19 Jan 2011, Mr Khurshid has held the office of Union Cabinet Minister, Water Resources and Minority Affairs. A keen man of words, Mr Salman Khurshid has published several works, notable among which are *At Home in India*, a restatement of Indian Muslims; *Beyond Terrorism*; *Sons of Babur: a play in search of India*; and his forthcoming book *If Winter Comes*. He has also edited *Contemporary Conservative*, selected writings of late Dhiren Bhagat; was the joint editor of the *Supreme Court Cases Journal, 1985-89*; and with Dr Rajeev Dhawan, has co-edited *Essays in Honour of Justice Krishna Iyer*. Mr Khurshid has published several legal articles in law journals of UK and India and contributed to the *International Law Volume* edited by Dr Kamal Hussain, Bangladesh, as well as the unpublished monograph on *Unconscionability in Contract*.



Dr R K Pachauri is Director-General, TERI; Director of the newly established Yale Climate and Energy Institute (YCEI); and President, TERI North America. He has been the Chairman of Intergovernmental Panel on Climate Change (IPCC) since 2002. He accepted the Nobel Peace Prize in 2007 on behalf of IPCC, which shared the honour with former Vice President of US, Mr Al Gore. He has been conferred with several awards, including 'Padma Vibhushan' the second highest civilian award

in 2008, 'Officier De La Légion D'Honneur' by the Government of France in 2006, and 'Padma Bhushan' in 2001 for his outstanding contribution in the field of science, engineering, and environment. He has recently been bestowed with the 'Commander of the Order of Leopold II' by His Majesty the King of Belgium. He is actively involved in several international forums dealing with climate change policies and has been associated as faculty with academic and research institutions of national and international repute. He has authored 23 books and several papers and articles.



Mr Ashok Jaitly, a Distinguished Fellow with TERI since 2002, is a 1964 batch Officer of the Indian Administrative Service having retired as Chief Secretary of Jammu & Kashmir State. Mr Jaitly holds several important positions in a number of civil society organizations, is on the committees of many Government Missions and has also served as Consultant to the High Level Steering Committee on Water Mission under the National Action Plan on Climate Change of the Ministry of Water Resources. He currently oversees the Water Group and all activities relating to Water and Sanitation in the Institute in addition to work on issues of sustainable development including natural resource management, rural energy and decentralized governance. He is also on the faculty of TERI University.



BIONOTES

SESSION CHAIRS



Mr Chandrashekhar Dasgupta was an Indian Foreign Service officer from 1962 to his retirement in 2000. Among other posts, he served as Ambassador to the European Union (1996–2000) and as Ambassador to China (1993–1996).

Mr Dasgupta has a long association with international negotiations on climate change and other sustainable development issues. He is presently a Member of the Prime Minister's Council on Climate Change; Distinguished Fellow at TERI; and Member of the UN Committee on Economic, Social, and Cultural Rights. He is the author of *War and Diplomacy in Kashmir 1947–48* and numerous articles on environmental issues and international affairs. Mr Dasgupta has been awarded the Padma Bhushan by the President of India.



Mr Ashok Jaitly, a Distinguished Fellow with TERI since 2002, is a 1964 batch Officer of the Indian Administrative Service, having retired as Chief Secretary of Jammu and Kashmir state. Mr Jaitly holds several important positions in a number of civil society organizations, is on

the committees of many Government Missions, and has also served as Consultant to the High Level Steering Committee on Water Mission under the National Action Plan on Climate Change of the Ministry of Water Resources. He currently oversees the Water Group and all activities relating to water and sanitation in the Institute, in addition to work on issues of sustainable development, including natural resource management, rural energy, and decentralized governance. He is also on the faculty of TERI University.



Mr Suresh Prabhu is the former Union Cabinet Minister of Industry, Energy, Environment and Forests, Chemicals and Fertilizers, and Heavy Industry and Public Enterprises. He has left an indelible mark on the functioning of the

ministries headed by him through his initiatives, long-term vision, positive approach, and transparency. As a Minister with the Government of India, he introduced several measures that went a long way in protecting the environment and ensuring sustainable development by conserving the natural resources and bringing electricity to the remotest possible corners of the country. He is actively involved in the international sphere, and is a Member of various Committees and Task Forces relating to environment and climate change and energy issues. He is also a senior advisor to the UN. He has been contributing regularly to leading national and international publications on very diverse topics like international affairs, environment, public policy, natural resources, and energy. He was elected member of the World Bank parliamentary network and nominated as the Chairman of the South Asia Water conference.



Dr Prodipto Ghosh is Member, Prime Minister's Council on Climate Change, and former Secretary, Environment and Forest in the Union Government from 2003 to 2007. He specializes on the interface of science, economics, and public policy. He has a PhD in Economics and Policy Analysis from the Carnegie-Mellon University, and BTech in Chemical Engineering from IIT-Delhi. He was

a Member of the Indian Administrative Service (IAS) from 1969 to 2007. He works on climate change and sustainable development policy.



Mr A K Misra is a Member of Indian Administrative Service and carries with him more than 35 years of experience as a field Administrator and policy-maker. Though his work and experience are in varied fields, with his experience as Principal Secretary in the Departments of Health, Education, Urban, and Rural Development in the state of Uttar Pradesh, he is in a unique position to understand the linkage between health, water, and sanitation and on its impact and possible remedial measures. Presently, he is Secretary, Government of India, Department of Drinking Water and Sanitation in the Ministry of Rural Development.



Dr S S Meenakshisundaram is a Post Graduate in Mathematics from Loyola College, Madras and holds a PhD in Development Economics from Jamia Milia Islamia National University, New Delhi. He joined the Karnataka cadre of the Indian Administrative Service in 1968. During his career, he held a number of assignments, including Secretary, Rural Water Supply, Rural Development, and Panchayati Raj departments when Karnataka launched its new system of panchayati raj institutions. He was a Visiting Fellow at the Institute of Development Studies at the University of Sussex, UK for one year. Besides several articles and papers on drinking water supply, Panchayati raj, and rural development, he has also published a book on “Decentralization in Developing Countries” during 1994. After working as Principal Secretary to the Chief Minister of Karnataka and Joint Secretary to three Prime Ministers of India, he also served as Adviser in the Planning Commission and Secretary in the Department of Drinking Water Supply in the Ministry of Rural Development. He was also the Deputy Chairman of the State Planning Board, Karnataka during 2007–08. Currently, he is the Executive vice Chairman of MYRADA, a voluntary organization in the field of building people’s institutions for development and Visiting Professor at Institute of Social and Economic Change, Bengaluru. His research interests include water-related issues, rural development, poverty alleviation, voluntary action, and decentralized governance.

Mr T Nanda Kumar, a 1972 batch Indian Administrative Services (IAS) officer of Jharkhand cadre, in his career spanning over 38 years, has been Secretary, Food and Public Distribution, Govt. of India, since July 2006 to August 2008. In September 2008, he took over as Secretary, Agriculture. He has had wide experience in areas ranging from agriculture and food to urban development, textiles, mines, commerce, and industry. He has also served as Secretary General, International Jute Study Group, an International Commodity Body under UNCTAD, and had contributed to meetings at the global level on international commodity policy. After his superannuation from service in February 2010, Mr Nanda Kumar joined the National Disaster Management Authority as a member. This Authority is an apex body for Disaster Management (DM) in India with the mandate of laying down policies, plans, and guidelines for DM and coordinating their enforcement and implementation for ensuring timely and effective response to disasters. He writes on agriculture and food policy for leading newspapers in India.



Mr Navin Kumar is a member of the Indian Administrative Service, the senior civil service of India. With 35 years of extensive administrative experience behind him, Mr Kumar is presently holding the position of Secretary to Government of India in the Ministry of Urban Development. Born in 1952, Mr Kumar did post graduation in Physics with first class academic credentials. He joined the Civil Service in 1975 at the early age of 23 and was assigned to the state cadre of Bihar. In his long career, he has held positions of responsibility in the state and central governments in areas such as education, social security, youth affairs, water resources, energy, industries, broadcasting, IT, and finance. Mr Kumar also worked as Technical Advisor to the Government of Sierra Leone for management of food aid under the Commonwealth Technical Cooperation Programme. With special interest in arts and media, Mr Kumar took up assignment as head of the national TV of India, Doordarshan, and served as its Director General from 2004 to 2006. Extensively trained in management and public policy, Mr Navin Kumar is a tech-savvy person. He writes computer programmes in his spare time. Besides, he takes keen interest in drawing and painting, trying his hand at fine arts at leisure.



Dr T Ramasami, currently Secretary to the Government of India, Department of Science and Technology, he holds a Master's degree in Leather Technology from the University of Madras, India and PhD in Chemistry from the University of Leeds, UK. He has also worked on energy research in Ames Laboratory Iowa, USA and on electron transport phenomena in the Wayne State University, USA prior to returning to India for undertaking his scientific career. He joined the Central Leather Research Institute, Chennai as a scientist in 1984 and served as its Director for more than 10 years during the period up to May 2006. Dr Ramasami has assumed the role of Secretary S&T in the Government of India since May 2006. He is currently engaged in the development of policies and programmes for attracting talent for study and careers with science, rejuvenation of research in universities, stepping up of international S&T cooperation, development of public-private partnerships in R&D sector and accountability of public funded research, development and demonstration. His contributions to the understanding of the chemistry and applications of chromium as well as leather science and environment-related technologies have earned him several professional recognitions in both India and abroad. These include Shanti Swarup Bhatnagar Prize for chemical sciences in 1993, election to all major science academies as a fellow as well the Third World Academy of Sciences, and the national civilian award Padma Sri in 2001.



Mr Ramaswamy R Iyer, formerly Secretary, Water Resources, in the Government of India, was Research Professor at the Centre for Policy Research (CPR), New Delhi, where he worked on water-related issues, and in particular on cooperation on river waters by India, Nepal, and Bangladesh (1990–99). He continues in CPR in an honorary capacity. He has been a member of many government committees and commissions, including the National Commission on Integrated Water Resources Development Plan (1997–99), and was the Chairman of a Task Force on Natural Resources, Environment, Land, Water, and Agriculture, set up by the Commission on Centre-State Relations (2008–09). From time to time, he

has undertaken consultancy assignments for the World Bank; the World Commission on Dams (WCD); the International Water Management Institute, Colombo; United Nations Development Programme (UNDP), New Delhi; the European Commission; and others. He was a Member of the UNSGAB High Level Expert Panel on Water and Disaster, an adjunct to the UN Secretary-General's Advisory Board on Water and Sanitation (August 2007–March 2009). He has published numerous articles and papers, edited /co-edited some books, and have authored the following books: A Grammar of Public Enterprises, Rawat Publications, Jaipur (1991); WATER: Perspectives, Issues, Concerns, Sage Publications (2003); Towards Water Wisdom: Limits, Justice, Harmony, Sage (2007), and Water and the Laws in India (ed) Sage Publications (2009).



Mr Jagmohan Lal Bajaj, is BA (Economics), Delhi University; MA (Economics), Delhi University; MA (Developmental Economics) Williams College, Mass, USA, and was with the IAS till 1995. He is currently in TERI as a Distinguished Fellow. Mr Bajaj has over 40 years of experience and has served in very senior positions in the Government of India and also worked as a senior consultant in the World Bank and UNDP. Mr Bajaj was the first Chairman of UPERC (1999–2003). He established the Commission and introduced regulatory practices in electricity management in the state. The Commission prepared Transmission Code and Supply Code for regulating Supply and introducing consumer friendly practices. Tariff selling in electricity is now based on an open and transparent process in which all stakeholders are given opportunity to express their views and give suggestions. Issued four-tariff order, which introduced the principles of performance-based tariffs in the state. Many new concepts like billing on the basis of kWh consumption and different tariffs for peak and off-peak hours have been introduced. Discussion paper has been issued on the open access policy prescribed by the Electricity Act 2003. He was member of the Committees on Distribution Reform, One time Committee on settlements of arrears of SEB's to Central PSU's, and the Committee on APDP and APDRP. Currently, he is member of the Task force on Power Sector Investments and Reforms.

BIONOTES

KEYNOTE AND SPEAKERS



Dr Abdin Mohd Ali Salih is Professor of Civil Engineering at the University of Khartoum and freelance consultant. His education includes first class honours degree in Civil Engineering from Khartoum and DIC and PhD from

Imperial College in London in 1973. He has held various academic positions at many universities in Africa, Middle East, Europe, and USA with full professorship since 1982. He has worked for UNESCO from 1993 to 2008 as regional hydrologist in Cairo, Deputy Secretary of the International Hydrological Program of UNESCO (IHP) in Paris, and Director of UNESCO regional offices in Cairo and Tehran. After retirement from UNESCO in 2008, he was elected as the President of the Intergovernmental Council of the IHP of UNESCO till 5 July 2010. He is still a member of the Bureau of the IHP and Member of the Governing Board of the UNESCO-IHE Institute for Water Education. Dr Salih has served as a consultant to many UN organizations, such as ESCWA, WB, WMO, UNU, UNESCO, national, regional, and international consultancy firms. He is the member of many scientific organizations, such as IAHR, IWRA, IAHS, IAH, ICID, and AWC. He has been awarded ISESCO AWARD for excellence in science.



Ms Abha Bahadur, a post-graduate in Economics, is a Senior Vice-President of Sulabh International Social Service Organization and Chairperson of the Sulabh International

Centre for Action Sociology. Sulabh is a well-known premium NGO in India in the water and sanitation sector. Ms Bahadur has been working with the organization since the last 20 years. She was earlier Chairperson-International Relations of the organization and has been liaising with the United Nations and various other international organizations in India and abroad for increased awareness and better coordination in programmes on environmental sanitation, to help meet the Millennium Development Goal on water and sanitation. She has keen interest in gender issues and has helped design and organize training programmes and camps in urban slums in Delhi for them, with emphasis on safe drinking water, sanitation, health, and hygiene. She has traveled widely and has participated and presented papers in many national and international conferences. Ms Bahadur was awarded the World Human Rights Promotion Award 2002 by the All India Institute of Human Rights, New Delhi.



Dr Aidan Cronin trained as a civil and environmental engineer and holds a PhD in water resources from Queens University, Belfast. He has worked in consultancy and as a Senior Research Fellow at the Robens Centre, University

of Surrey, UK where he spent five years looking at the impact of anthropogenic activities on water quality in the EU and developing country settings. He worked as a Water and Sanitation advisor at the United Nation High Commissioner for Refugees in their Public Health Section

in Geneva, Switzerland before joining UNICEF India in 2008. He managed the UNICEF water and sanitation programme in Orissa state, India up to September 2010 when he joined the New Delhi office as the water advisor.



Mr Ajit M Nimbalkar completed his MA in Political Science and Public Administration from Bombay University and joined the Indian Administrative Service in 1967. During his 37 years of service in the IAS, he held several posts in the state as well as central government. This included Chairman, Maharashtra State Electricity Board, VC and MD of Maharashtra State Road Development Corporation as well as MD of Mahanagar Gas Limited, a joint venture of GAIL and British Gas. At Govt. of India, he was Director General, Employment and Training. Later on, he became Special Secretary in the Ministry of Home Affairs and then Secretary, Defence Production. He was recalled by the state government to head the administration as Chief Secretary, Maharashtra in October 2002 and retired from there on 31 May 2004. In 2005, the Government of Maharashtra enacted Maharashtra Water Resources Regulatory Authority Act, which provides for the establishment of an independent Water Resources Regulatory Authority to regulate water resources, facilitate and ensure judicious, equitable, and sustainable management, allocation and utilization of water resources, and fix the tariff for bulk water users. Mr Nimbalkar was appointed as the first Chairman of the Authority and continues in the position as on today.



Dr Alok K Sikka is Technical Expert (Watershed Development), National Rainfed Area Authority (NRAA), Planning Commission, Government of India, New Delhi. Before joining NRAA, he was Director of ICAR Research Complex for Eastern Region, Patna and Basin Coordinator for Indo-Gangetic Basin of the CGIAR Challenge Program on Water and Food. He is PhD in Civil and Environmental Engineering with specialization in Hydrology and Water Resources Engineering from Utah State University, Logan, Utah, USA. He has a rich and diverse experience of over 32 years in research, institutional and policy issues, teaching, training,

extension, and consultancy in the areas of watershed management, water harvesting, hydrologic modelling, drought studies, climate change, water management, water productivity, farming system, and so on. He has more than 200 publications in the form of research papers in international and national journals/proceedings, book chapters, bulletins, and books to his credit. He is the recipient of many national awards, including Vasant Naik Award-2000 of ICAR for Research Application in Agriculture for outstanding contribution in the field of Water Conservation and Dryland Farming, ICAR Award for Team Research for the Biennium 2001-02, Hem Prabha – S.N. Gupta Medal (2000), Certificate of Merit (1989-90) of Institution of Engineers (India), and National Fellow, Indian Association of Soil and Water Conservationists. He has been the member of many national and international committees.



Dr Anamika Barua is an Ecological Economist and is working as an Assistant Professor in the Department of Humanities and Social Sciences, Indian Institute of Technology, Guwahati. Her core research to date has focused on assessing social vulnerability to climate change and livelihood dynamics. More recently, she has collaborated with researchers from Lund University of Sweden to investigate social vulnerability and adaptation to climate change in the districts of Sikkim. The project has been funded by Swedish Research Council (SRC). She is also working in collaboration with researchers from University of Leeds, UK, in a project focusing on 'Developing a Measure for Inequitable Household Access to Water in Urban India', funded by ICSSR and ESRC. Apart from research at IIT, she teaches Ecological Economics, both at the Masters and the undergraduate level. Prior to joining IIT Guwahati, she was associated with the Water Resources Division at The Energy and Resources Institute (TERI), in New Delhi.



Dr Andreas Schild is a development specialist with over 30 years of experience in designing, planning, executing, and monitoring cooperation programmes, mainly in sustainable natural resource management and rural development.

He is familiar with the Hindu Kush-Himalayan region through various long-term assignments (Afghanistan, Bangladesh, and Nepal) and multiple missions to all of ICIMOD's regional member countries. He has acquired considerable management experience through a number of positions that he has held, including Country Director of Swiss Development Cooperation in Nepal and Rwanda/Burundi; Executive Director of Intercooperation, a major Swiss NGO; and Chief Technical Advisor in North Korea for the UNDP-financed aid coordination programme. Dr Schild has a PhD in History and Sociology from the University of Berne in Switzerland. Dr Schild was awarded the Sir Edmund Hillary Himalayan Environment Award at the Headquarters of the Indian Mountaineering Foundation (IMF) in New Delhi, India.



Mr Anshuman, Fellow, Water Resources Division of TERI has been working in the water sector since the last 14 years. His key qualifications include MTech in Energy and Environmental Management from Indian Institute of Technology (IIT), New Delhi. His expertise lies

in the areas related to water resource assessment and management with a focus on IWRM; urban water supply and demand management studies; water audits, watershed management, water conservation, pollution assessment; and water and climate change. He has executed several related projects, presented several papers at national and international forums, and has several relevant national and international publications.



Dr Arabinda Mishra is an economist with research experience covering varied themes, such as climate change risks and community-level vulnerability assessment, institutions and governance aspects of environmental management,

natural resource accounting, management of ecosystems and their services for poverty alleviation, and trade-related environmental regulations. His expertise is in methods of economic analysis and he is involved in education and training of development professionals, providing advisory support on climate policy to government agencies, research supervision, and large-scale project management. Dr Mishra is currently leading

TERI's engagement with a number of state governments in India for preparing State Action Plans on Climate Change. He has to his credit a number of publications and has participated in as well as organized a number of international seminars / conferences / workshops.



Mr Arjun Thapan's interest in water goes back to 1981 when he was engaged in the planning work for the Narmada (Gujarat) Project in India. He helped monitor and implement several irrigation projects, funded by external agencies,

during his 4-year stint with the Department of Economic Affairs in India's Ministry of Finance. In 1991, Mr Thapan was hired by the Asian Development Bank as a Financial Analyst in its Water Supply and Urban Development Division (West). As he grew through the system, Mr Thapan designed, prepared, and helped implement numerous urban and rural water supply and sanitation projects in Bangladesh, Cambodia, India, Laos, Nepal, Sri Lanka, Thailand, and Viet Nam. His experience in water has gone beyond urban and rural water supplies. In Thailand, he prepared a policy-based loan for \$600 million in 1998 to support Thailand's agriculture sector. The restructuring of Thailand's irrigation sector took place as a result of this reform programme. In Bangladesh, he worked on urban flood protection and drainage under the auspices of the internationally developed Flood Action Plan. Mr Thapan cut his teeth into environmental sanitation in India, where he prepared and worked on the implementation of the Calcutta Environmental Improvement Project. Mr Thapan was appointed by President Kuroda as his first Special Senior Advisor for Infrastructure and Water in January 2010.



Dr Ashok Chapagain is Senior Water Advisor with WWF-UK, working at both UK and the international level on freshwater and sustainable consumption issues. His current role at WWF-UK is to drive the agenda of

better water stewardship, help multinational businesses to understand global water risks and encourage them to address the environmental impacts of their water of India on various urban issues and assisting various city and state governments on City Development Plans and

in implementation reforms under the Jawaharlal Nehru Urban Renewal Mission (JNNURM). NIUA is the National Coordinator for Peer Exchange and Reflecting Learning (PEARL) programme under JNNURM. He is coordinating a large number of urban studies, including City Cluster Economic Development in National Capital Region of Delhi, Sustainable City Form for India, Property Tax Reforms, City Sanitation Plan Preparation, Implementation of 13th Central Finance Commission Recommendations for Urban Local Bodies, and so on. He is also on the Editorial Boards of Environment and Urbanization Asia and Urban India journals. Prior to joining NIUA in February 2008, he was working as Deputy Project Leader, Indo-USAID Financial Institutions Reform and Expansion Program (FIRE) during 1995–2008. Major objective of the programme is to develop commercially-viable urban infrastructure projects with focus on urban poor.



Dr Colin Chartres is the Director General of the International Water Management Institute (IWMI), one of the 15 research centres of the Consultative Group on International Agricultural Research (CGIAR). Colin has over 30 years experience in research and policy reform in natural resources management in Australia and a range of developing countries. At IWMI, Colin leads a team of international scientists working on future water availability, agricultural water productivity improvement, reuse of wastewater in agriculture, ecosystem services, and water governance and management. Prior to joining IWMI in 2007, Colin was Chief Science Advisor to Australia's National Water Commission where he focused on ensuring reform processes were based as best possible on scientific evidence. Previously, he held senior research and management positions with Australia's CSIRO, the Bureau of Rural Science and Geoscience Australia, and has also worked in academia and the private sector. He is also the co-author of *Out of Water*, published in August 2010 by The Financial Times Press.



Dr C A Bons is an experienced water quality engineer who can rely on a sound background in hydrology and earth sciences. His research experience in both surface and groundwater hydrology

forms a good foundation for the integral approach to solving water management problems, which has been his key occupation for many years. Mr Bons has been involved in the design, set-up, and implementation of IWRM projects for several large river basins in Europe and Egypt. Mr Bons was involved in many projects related to water quality monitoring, data presentation, and analysis. This concerned also the update of monitoring systems for the Water Framework Directive (WFD). Besides his European experience, Mr Bons has five years experience in the Arid zone (Egypt) in water quality planning and monitoring, in addition to several months in Botswana and Saudi Arabia and three years experience in the tropics (Indonesia) regarding integral impact assessment of forestry activities. Since 2003, he became involved in the management of Deltares as director of the Unit Inland Water systems, the Unit Scenarios and Policy Analysis, and recently the Unit Subsurface and Groundwater Systems.



Prof. Damia Barceló Is a graduate in Chemistry (1977) and PhD (1984) in Analytical Chemistry from the University of Barcelona. Since 1999, Prof. Barcelo has served as full Research Professor at IDAEA-CSIC and Head of the Environmental Chemistry Department till may 2008. Since this date, he also served as the Director of the Catalan Institute for Water Research (ICRA) and from 2009 as Visiting Professor at King Saud University, Riyadh, Saudi Arabia. He has published over 620 scientific papers in journals of SCI, 120 book chapters, is the co-author of 1 book on pesticides analysis in the environment, and is editor of 19 books on environmental analysis and fate of pollutants. He is editor of the book series *Wilson + Wilson Comprehensive Analytical Chemistry*, (Elsevier, Amsterdam, NL) the *Handbook of Environmental Chemistry* book series (Springer-Verlag), Associate Editor of *Trends in Analytical Chemistry* (Elsevier, NL) and *Environment International* (Elsevier, NL), and member of the Editorial board of SCI journals, *Analytical Bionalytical Chemistry* and *Talanta*. Member of the Scientific Panel of the European Food Safety Authority (EFSA) (2004–2009) and Panel Member of the European Young Investigator Awards (EURYI) from ESF (2004–2007), and since 2010 reviewer of the

European Research Council (ERC). He is co-ordinator of the projects CONSOLIDER-INGENIO 2010 project funded by the Spanish Ministry of Science and Innovation entitled “Assessing and predicting effects on water quantity and quality in Iberian rivers (SCARCE)” ; the EU-funded project INNOVA-MED Innovative processes and practices for wastewater treatment and re-use in the Mediterranean region; and project funded by the King Saud University (KSU-VPP-105) Fate and Assessment of Emerging Persistent Organic Pollutants (Perfluorinated compounds and Fullerene nanoparticles): environmental and human health implications.



Dr Dipak Gyawali, who is Pragma (Academician) of the Nepal Academy of Science and Technology and Research Director of the Nepal Water Conservation Foundation, studied hydroelectric power engineering from Moskovsky Energeticheskyy Institute, USSR (1979) and Political Economy of Resources at the Energy and Resources Group of the University of California, Berkeley (1986). His interdisciplinary research agenda focuses on society technology resource base interface, with water and energy as entry points. He served as Nepal’s Minister of Water Resources (responsible for power, irrigation, and flood control) between November 2002 and May 2003, chairs Nepal’s first liberal arts college, and is on the advisory board of associations dealing with community electricity, biogas, water supply, and sanitation, and so on. He was UNESCO/UNU-IAS Visiting Professor of Water and Cultural Diversity in October/November 2010, and is currently the Vice-Chair of the Technical Advisory Committee of United Nations’ World Water Assessment Program. Currently, he is the advisor to the National Association of Community Electricity Users’ Nepal and Nepal Biogas Support Program.



Dr Eddy Moors is Head of the Earth System Science Climate Change (ESS-CC) group of the Centre for Water and Climate at Alterra Wageningen University and Research Centre. The expertise within the group covers a broad range of disciplines, from physical oriented to more socio-economic expertise. He is involved in

research related both to mitigation and to adaptation issues of climate change. His research expertise includes hydrometeorology, micrometeorology, measuring and modelling of land cover-atmosphere exchange processes, and carbon cycling. Monitoring expertise includes fluxes of water, carbon, and heat, in system design, operation, data management, and process analysis. Modelling expertise includes detailed process-based modelling, land-use atmosphere feedbacks as well as precipitation-runoff models at the catchment scale. He coordinates and participates in a number of international projects, such as,

- HighNooN: adaptation to changing water resources availability in northern India with Himalayan glacier retreat and changing monsoon
- BRIDGE: Sustainable uRban plannIng Decision support accountinG for urban mEtabolism
- ACER: Developing Adaptive Capacity to Extreme event in the Rhine basin
- Adaptation strategies for shoreline development in San Francisco Bay



Mr Fergal Whyte is a civil engineer by profession and is currently Director at Arup, a global consultancy firm. Apart from number of assignments in Arup, Mr Whyte is leading the water team in the Asia region for innovation and application of state-of-the-art technology in the areas of challenges and opportunities for global water security, water vulnerability, climatic change impact, water quality, and sustainability. In addition, he has extensive experience in master planning, feasibility, preliminary and detailed design, coordination, contract documentation, and supervision of major infrastructural projects in the UK, India, China, and South-East Asia. Based in Hong Kong since 1992 and as a Director within the Arup Hong Kong Civil Engineering Group, he has served both public and private clients under a variety of contract types, such as Design and Build, PFI as well as standard government contracts. He has accumulated specific experience in the water situation in Hong Kong for clients, such as the Development Department, MTRC, and overseas in India, Thailand, Philippines, China, and the UK. As global water leader, he chairs the firm’s Global Water Executive, responsible for developing business, identifying areas of research and staff development with the water business.



Mr Ganesh Pangare is currently the Coordinator, Regional Water and Wetlands Program, IUCN, Asia Regional Office, based in Bangkok, Thailand. His main area of work over the last two decades has been in people-centered water interventions, watershed management, participatory irrigation management, wetlands management, and integrated water resources management. His present work is focused on water sector reforms and water governance at national, regional, and global levels, with a focus on natural infrastructure. Mr Ganesh was a member of the High Level Working Group on Watershed Development, Rainfed Farming, and Natural Resource Management of the Planning Commission, Government of India, for the Tenth Five-Year Plan (2003–2007). Prior to joining IUCN, he worked as Associate Coordinator at the International Secretariat of The Water Dialogues, London, UK. This project was funded by GTZ and DFID. Mr Ganesh is a Fellow of the London-based Leadership for Environment and Development (LEAD) International Program. He is also a Fellow of the Ashoka Innovators for the Public Program based in Washington, and a Fellow of the East-West Centre, Hawaii. He is also an Advisor to the Water Portfolio of the Acumen Fund, USA. He has written more than 10 books on water-related issues. He has also published several monographs and papers in reputed journals and magazines. He has done consulting work for the World Bank, International Food Policy Research Institute, Asian Development Bank, Ford Foundation, United Nations Research Institute for Social Development, Danida, GTZ, India-Canada Environment Facility, WWF, Government of India, and many other national and bilateral organizations.



Dr Iskandar Abdullayev has over 15 years of experience in irrigation and drainage management, water institutions, water allocation, and water distribution in Afghanistan and all five Central Asian countries. He received his PhD in water management in 2000 and MSc in Hydrotechnical Engineering in 1992. Prior to joining German International Cooperation (GIZ) as regional advisor, he worked in leading institutions that include ZEF Centre for Development Research,

University of Bonn (Germany), International Water Management Institute (Sri Lanka). Dr Abdullayev also has experience with national institutions. He worked as assistant of the professor for Tashkent Institute of Irrigation and Melioration, Uzbekistan Ministry of Agriculture and Water Resources. He is a founder of the NGO Association of Uzbekistan for Sustainable Water Resources Development (Suvchi). He has written over 30 peer reviewed articles, policy papers, and conference papers. Dr Abdullayev has worked 8 years in the Fergana Valley on pilot testing of IWRM principles for selected irrigation systems of Central Asia. He worked 2 years in the Kunduz Irrigation System of Afghanistan for studying water management and local irrigation systems and impact of the interventions by international projects on local water management situation. Dr Abdullayev has researched emerging local water management institutions in the Lower Amudarya Basin-Khorezm region of Uzbekistan.



Dr Joe Madiath completed his studies in English literature from Madras University. As a student, he was elected as the President of Madras University Students' Union and founded the Young Students' Movement for Development (YSMD) to harness positively the student disenchantment prevailing during the period. In 1969, as a student, he journeyed across India, Nepal, Bhutan, and Sri Lanka on a bicycle for a year. In 1971, Joe led 400 YSMD volunteers to manage a number of relief camps for refugees from Bangladesh. Later that year, 40 volunteers along with Joe, moved to Orissa, which had been ravaged by a cyclone and tidal waves. Joe and a few colleagues decided to stay on in the area after relief work to work as development activists. They moved to the Ganjam District in southern Orissa in 1976 on invitation from the government, to initiate development activities among the indigenous communities. This resulted in the establishment of Gram Vikas in 1979. Since its inception, Joe has been the Executive Director of Gram Vikas. Gram Vikas, today, is one of the largest NGOs in Orissa, reaching out to about 59,132 indigenous and poor families, living in 943 rural habitations. Some of the pioneering efforts of Gram Vikas have been in biogas promotion, community forestry, rural habitat development, and education. Gram Vikas'

current approach to convergent community action with water and sanitation as the entry point is evolving into a movement influencing local democratic self-governance and poor people's control over development processes. Recipient of awards: Shawn Feinstein World Hunger Award; Global Development Network Award (1998); World Habitat Award (2002); Kyoto World Water Grand Prize (2006); Social Life Time Achievement Award by Godfrey Phillips Red and White Bravery Awards (2006); NGO of the Year (2006) by Resource Alliance; and Skoll Award for Social Entrepreneurs (2006) by Skoll Foundation, USA.



Dr J R Sharma joined ISRO in 1987 after eight years of teaching at the University of Rajasthan, Jaipur and is currently Scientist/Engineer 'G' and Group Director at National Remote Sensing Centre, ISRO, Department of Space, Hyderabad and having multiple scientific/technical/ managerial/administrative responsibilities. He is General Manager/Head of Regional Remote Sensing Centre (West) of ISRO, Jodhpur since the last 21 years and has directed nearly 200 studies related to natural resources management in general and water resources in particular of local, regional, and national importance using remote sensing and GIS; interacted and networked with more than 100 user agencies mostly from India and also with international bodies. He has also acted as director/facilitator for capacity building of number of NGOs, state and central govt. departments, teaching faculty, researchers, and individuals for remote sensing and GIS technology and applications. Currently, as Project Director, India - WRIS Web GIS, he is leading a team of 80 scientists/engineers across eight ISRO centres to develop Web-enabled water resources information system for the country. He has traveled widely and due was awarded by Land use Management Society, Hyderabad, the Leadership Award 2003 for Applications of Remote Sensing for Sustainable Development; by SIERA Atlantic, Hyderabad, in 2007 for Development of s/w KASHAMTA - Reservoir Capacity Estimation; and by Veer Durgadas Rathore Samriti Samiti, Jodhpur for Veer Durgadas Rathore Award - 2008 for Science & Technology Applications.



Dr J S Thakur graduated in Medicine in 1989 and holds MD degree in Community Medicine from IG Medical College, Shimla and Diplomate of National Board (DNB) in Family Medicine. He has also done a national course on the burden of disease studies and IARC International Course on Cancer Epidemiology. Dr Thakur has more than 15 years of public health experience working with health services, teaching, and research. Before joining WHO India-Country Office on 14 April 2009, he was Associate Professor at the School of Public Health, Post Graduate Institute of Medical Education and Research, Chandigarh, teaching Masters in Public Health (MPH) and MD courses. He is a Fellow of the Indian Public Health Association and Indian Association of Preventive and Social Medicine and a member of several professional bodies. His main professional interests are control of non-communicable diseases, health promotion, disease surveillance, and capacity building. He has worked as key investigator in many NCD-related projects, including Chandigarh Healthy Heart Action Project (CHHAP), which have been up scaled to state NCD control programme, developing models for district NCD control programmes, healthy workplaces, and health-promoting schools for prevention of NCDs, population-based screening for cervical and breast cancer, and formulation of clinical management guidelines for cardiovascular diseases for NPDCS.



Dr Krishna Kumar is currently working as a NOAA-CIRES Visiting Research Scientist at University of Colorado, Boulder, USA and is permanently affiliated with Indian Institute of Tropical Meteorology, Pune, India. His areas of interest and specialization include, Indian monsoon variability and predictability, climate change, development of future climate scenarios, and impact assessment. He obtained his PhD in Atmospheric Physics from University of Pune and did his postdoctoral research at Columbia University, New York. He has received several national and international awards and recognitions for his contributions to Atmospheric Sciences. Some of the awards include, the First Certificate of Merit Award

of Ministry of Earth Science, Government of India; Norbert Gerbier-Mumm International Award of the World Meteorological Organization (WMO); SAARC Young Scientist Award; and IITM Silver Jubilee Award. He is a Fellow of the Indian Academy of Sciences, Bengaluru; Associate Member of the Abdus Salam International Center for Theoretical Physics (ICTP); and a Coordinating Lead-Author of the IPCC's Fifth Assessment Report (AR5). He has published more than 50 research papers in many peer-reviewed national and international journals including two highly cited papers in Science.



Mr Krunal Negandhi is Assistant Vice President- Projects (Environment) with Lavasa Corporation Ltd, the company that is developing a hill-station spread over 12,500 acres in the back-waters of the Warasgaon Dam. He spearheads the company's initiatives in sustainability, environment management, and green activities. He is responsible for the implementation of Environment Management Plan (EMP), all landscaping and greening activities, green building and green neighborhood initiatives, Global Reporting Initiative (GRI), and other activities within the sustainability matrix. The vision of Lavasa is to build a world-class tourist destination wherein people live in harmony with nature. This creates a new set of challenges and opportunities as the development is being done from scratch. Krunal has been involved from the beginning of the development and worked as an Executive Assistant to the CEO assisting him in all the corporate functions. He later on moved on to Environment and has been spearheading the Environment activities at Lavasa since the past 5.5 years. Under his leadership, Lavasa has initiated a lot of environmental activities, some of them being the first of its kind in the country, such as Hydroseeding, Soil Bio-Engineering, and Bio-mimicry. He has also introduced Integrated Rainwater Management and built a separate enterprise for local villagers to make products from local material "Bamboo". Mr Negandhi has a Bachelors Degree in Civil Engineering and a certificate course in Environmental Quality Management. He has personal interests in reading, travelling, and spirituality.



Dr Leena Srivastava is currently the Executive Director (Operations), TERI, New Delhi. She has worked on a range of issues covering energy policy/planning, energy pricing, regulatory issues, and economics of energy development pathways in India. Dr Srivastava worked extensively on climate change issues from the early 1990s and has participated actively in various reports of the IPCC (Intergovernmental Panel on Climate Change). She was a Member of India's National Security Advisory Board and the Committee on Integrated Energy Policy. Dr Srivastava has a number of books and research publications to her credit. She is on the editorial boards of various international journals.



Dr Madhusudan Dhananjay Chaudhari is a Senior Manager at Jain Irrigation Systems Ltd, Jalgaon, Maharashtra, India. He holds a PhD from IIT-Bombay in Structural Engineering. He has worked as a Pipeline Engineer in United Kingdom for installation of large diameter sea-based steel pipelines. He has also worked as a Civil Engineer in USA (University of Arizona) on construction of multi-storey steel buildings and multi-storey car parking garages.



Dr Manish Kumar is presently Secretary to Government of Tripura, Agartala. He has been Secretary, Home and Secretary, Power to Government of Tripura. Dr Kumar started his career in 1991 as an Indian Administrative Service Officer and has held positions like District Magistrate and Collector, West Tripura District, Agartala, Secretary to the Chief Minister of Tripura, Additional Secretary, Department of Finance. As Chief Executive Officer, District Water and Sanitation Mission, he provided operational leadership for implementing the World Bank/UNICEF- supported water supply and sanitation reforms project of \$100 million in West Tripura District, resulting in best output indicators for West Tripura District compared to all other districts in India. He was selected as Edward S Mason Fellow by Harvard University for demonstrating outstanding leadership in

public administration while serving the Government of India and did his Masters in Public Administration from Kennedy School of Government, Harvard University, USA. He holds a PhD degree in Public Policy from George Washington University, USA. He has worked in the World Bank, Washington DC in the Water and Sanitation sector, wherein he has contributed significantly to the advocacy document on water supply and sanitation strategy for Middle East and North African countries with reference to Millennium Development Goals, recommending increased World Bank investments in the WSS sector and focusing on countries with low MDG achievement. He has also contributed to World Bank's initiative for benchmarking water supply utilities in MENA countries. Dr Kumar worked with UNICEF as a Water and Environmental Specialist. He assisted the Government of India in building capacity of senior, middle, and junior officials linked to water and sanitation programmes through comprehensive multi-year training plans designed to improve sector knowledge and policy dynamics as relevant to each level of management.



Mr Mark Smith is the Head of the IUCN Water Programme. He leads IUCN's work on water, environment, and development at the global level and provides strategic leadership for IUCN on water policy in major international forums. He coordinates IUCN's flagship Water and Nature Initiative, which works through regional IUCN teams in Latin America, Africa, the Middle East, Asia, and Oceania on developing, testing, and promoting innovative, integrated solutions to water problems. Prior to joining IUCN in April 2006, he was a scientist with areas of specialization in agriculture, forestry, and hydrology. Between 1991 and 2000, his work focused primarily on agroforestry, first in the Sahel in West Africa, with the University of Edinburgh, then in Kenya, while working at the UK Centre for Ecology and Hydrology. From 2001 to 2004, he was leader of the interdisciplinary Livelihoods and Environment research group at CSIRO Sustainable Ecosystems in Australia, which applied integrated social, economic, and ecological tools to support sustainable development in tropical river catchments. Mark spent 2005 as policy advisor on climate change and poverty at the UK development NGO Practical Action, and was

author of the book "Just One Planet: Poverty, Justice, and Climate Change". He holds an undergraduate degree in agriculture, Masters in Climatology, and a PhD in Ecology.



Dr Mats Eriksson is a project director at SIWI with a special mandate to focus on climate change, water, and adaptation. He has recently worked for the last five years on climate impact on water resources and hazards in the Hindu Kush-Himalayas, particularly focusing on adaptation to climate- and water-induced hazards. Eriksson has also worked for many years on matters related to environment and development on the African continent. Here he was involved in support to transboundary water management, and he studied land use, natural resources, soil erosion, and climate, mainly in a historical perspective, leading to his PhD in Geography from Stockholm University. Dr Eriksson has a large network of contacts, worldwide, in the field of natural resources management, particularly to organizations and individuals involved in water, climate, and adaptation, and with a development focus. In the past, Eriksson has worked as a researcher and lecturer at Stockholm University (10 yrs) and at the Swedish International Development Cooperation Agency (Sida) with Integrated Water Resources Management in a transboundary context (5 yrs), and at the International Centre for Integrated Mountain Development (ICIMOD) (5 yrs). He has also worked at the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia on environmental history of rivers in south-eastern Australia.



Dr Mihir Shah was invited by India's Prime Minister to be Member, Planning Commission in June 2009, becoming the youngest person ever to occupy this position. Dr Shah is working on a new strategy for sustainable water resource management that he has been asked to draft by the PM. He is Co-Founder, Samaj Pragati Sahayog, one of India's largest grass-roots initiatives for water and livelihood security, working with its partners on a million acres of land across 72 of India's most backward districts. This work shows that watershed development combined with

bio-diverse agriculture, other nature-based livelihoods, and institution-centred micro-finance, can result in sustained higher incomes and empowered communities. A PhD in Economics from the Jawaharlal Nehru University, New Delhi, Dr Shah combined 20 years of living and working at the grassroots in tribal central India, with academic research and policy advocacy. He played a key role in shaping the National Rural Employment Guarantee Act.



Dr Mukand S Babel is an Associate Professor and Coordinator of Water Engineering and Management programme at the Asian Institute of Technology (AIT), Thailand. He also leads the Asian Water Research and Education (AWARE) Center at AIIT, a regional centre of excellence on capacity building and research and outreach in sustainable water management. Dr Babel's professional experience in teaching, research, and consultancy spans over 25 years mainly in India, Thailand, and Vietnam. With a PhD in water resources engineering, his current research emphasis is on hydrologic and water resources modelling, including assessment of the impacts of climate change and adaptation. With over a hundred publications in international refereed journals, book chapters, and conference proceedings, he currently leads interdisciplinary research related to hydrology and water resources with economic, environmental, and socio-economic aspects of water to address diverse water problems and issues in Asia. Dr Babel has carried out several capacity development, research, and sponsored projects in collaboration with international agencies/organizations, such as Danida, UNEP, ADB, UNESCO, UNU, IGES, APN, and universities in Japan, South Korea, and USA.



Dr M J M Kuijper studied Geology, Physical Geography, and Hydrology at the VU University in Amsterdam. From 2002 until 2009, she worked as hydrogeologist at the unit Subsurface and Groundwater Systems of TNO. Since 2009, she is affiliated with Deltares, the Netherlands research institute for water, soil, and the subsurface. Ms Kuijper is experienced in working with regional-scale

groundwater models, geographic information systems (GIS), remote sensing data and expert in integrated water system analysis, and groundwater monitoring and groundwater management. Her research concerns translating hydrological knowledge into practical measures and applications, focusing on restoration of natural ecosystems, safe and sufficient drinking water, and the impact of land use and human activities on groundwater systems. She advises drinking water companies, national and local governments, water boards, businesses, and NGOs. Since 2007, she has been working in India on groundwater management in Mango farms (Karnataka, 2008) and on rural drinking water and sanitation (Orissa, 2007-recently). She initiated the barefoot hydrologist project in Orissa, India, where she worked on capacity building in groundwater management and research on groundwater use for drinking water and its interaction with sanitation systems.



Ms Nafisa Barot is the Executive Director at Utthan, a committed, independent, non-governmental agency working to demonstrate sustainable, gender-sensitive processes for development. Her areas of interest include community mobilization, gender empowerment, institutional building, networking and advocacy, human rights, conflict resolution and peace building, livelihood security through natural resource, and disaster management. She is the member of the following committees—Executive Committee, CAPART; National Alliance of Women's Organization; Task force committee, National Bank for Agriculture and Rural Development (NABARD); Executive Committee, Development of Women and Children in Rural Areas (DWACRA). She has been honoured with the T N Khoshoo Memorial Award (2005) by Ashoka Trust for Research in Ecology and the Environment for exemplary work in conservation and sustainable development for the year 2005. She has participated in various conferences across the world.



Mr Patrick Yadauga, Vice President Supply Chain, India Company Owned Bottling Operations has more than 30 years of experience in the area of supply chains with Coca-Cola Enterprises,

predominantly in North America, and for a few years in Europe and Latin America. He heads the Integrated Supply Chain for Hindustan Coca-Cola Beverages Pvt. Ltd, which is responsible for procurement of raw materials to the shop shelf.



Dr Praveen Kumar Mehrotra, Director Water Quality Division, FPARP and IEC Division in Ministry of Water Resources and has vast experience in Water Resource Management and actively participates in decisions of policy making

and planning for water resources. As head of Water Quality Division and FPARP programme, he spearheaded in implementation of different projects especially in water quality and efficient use of water resources in the irrigation sector. FPARP has already demonstrated the impact of technology in conserving water and yet have higher productivity for ensuring food security. With basic degree in agriculture, MPhil in Sociology, and PhD in Biochemistry, he has given a flip for multi-disciplinary approach in water resource management. He has been gold medalist throughout his studies. He has wide range of experience in administrative, finance, project management, and has headed many divisions in MTNL, Ministry of Telecommunications, and departmental posts in different capacities. Wide exposure in handling public services in DoT, DoP, and other departments along with international exposure in several countries has given him added advantage in planning and addressing public services in the Ministry of Water Resources. He has several papers to his credit in many journals, seminars, and workshops.



Dr Paul McShane is Chief Research Officer of the Monash Sustainability Institute, Monash University. With post-graduate qualifications in science and business, Paul has held senior research management positions in Australia

and in New Zealand. Further to this, he has worked extensively in Asia providing advice to governments on sustainable development of marine resources. He is currently responsible for developing and managing major multidisciplinary projects addressing sustainability issues (climate change, energy, water) nationally and

internationally on behalf of Monash University. In previous roles, Paul was managing director of Global Marine Resource Management Pty Ltd, Director of the Australian Fisheries Research and Development Corporation, Director of Australian Marine Science and Technology Ltd (AMSAT), Vice President (international and development) and Professor of Marine Science at the Australian Maritime College, research manager SARDI Aquatic Sciences, and programme leader at the National Institute of Water and Atmospheric Research (New Zealand). He is a Fellow of the Australian Institute of Company Directors.



Mr Philippe de Taxis du Poët's educational background in France is “Ingénieur” in biological engineering and he has a PhD in the biotechnology field. Before joining the European Commission in 1991, he worked in

Canada in the pulp and paper industry in 1983 and 1986, in the electronics industry in Japan and at the University of Tokyo in 1987–1989, and in the pharmaceutical industry in Italy in 1989–1991. At the European Commission since 1991, he worked in the Research and Innovation Directorate General of the European Commission on public and private investment in research and technological innovation. In 2005–2009, he was posted as Head of Science and Technology at the Delegation of the European Commission to Japan. Since 2009, he is Head of the Science and Technology at the Delegation of the European Union to India.



Mr P G Dhar Chakrabarti, an Indian Administrative Service officer with more than thirty years of experience of working at local, state, national, and international levels, Mr P G Dhar Chakrabarti has been heading the National Institute

of Disaster Management since 2005 and the SAARC Disaster Management Centre since its inception in 2007. He has been associated with a number of advisory bodies and expert groups of the United Nations and other organizations. He is author of many publications on disaster risk reduction and development and editor of Disaster and Development and Journal of South Asian Disaster Studies, which he founded.



Dr Prateek Sharma is presently working with TERI University as Dean, Faculty of Applied Sciences. He has more than 15 years of research/teaching experience. His general research interests focus on environmental systems modelling, statistical applications in environmental and water resources engineering, and environmental risk assessment. He has more than 20 research publications to his credit. He has also authored three books, all international editions, in the area of environmental modelling and stochastic modelling. At present he is writing a book titled, Environmental Data Analysis and Air Pollution, likely to be published next year. He is a member of several professional societies. He has been admitted as a Fellow of Wessex Institute of Great Britain in 2004, in recognition of outstanding scholarly work. Prior to joining TERI University, Prateek worked for the School of Environment Management, GGS Indraprastha University for nine years. He was involved in developing the curriculum for the Master's programme in Environmental Management and Disaster Management.



Dr Qazi Kholiquzzaman Ahmad, an economist and development thinker and practitioner, is Chairman, Governing Body, Palli Karma-Sahayak Foundation (PKSF) and Chairman, Governing Council, Dhaka School of Economics. He is also the Coordinator of the Climate Change Negotiating Committee, Government of the People's Republic of Bangladesh. Founder Chairman of the multidisciplinary research organization Bangladesh Unnayan Parishad (BUP), Dr Ahmad is also the past President, Bangladesh Economic Association (BEA) and a former Research Director at the Bangladesh Institute of Development Studies (BIDS). In a career spanning over four decades, he has extensively participated in research activities and dialogues, nationally and internationally, covering various social, political, economic, water, and environmental/climate change aspects and issues of sustainable development as they relate to Bangladesh and other developing countries. Dr Ahmad has to his credit a wide range of research works and publications (including authored/co-authored/edited/co-edited 34 books and over 200 articles/research reports and papers), at home and

abroad, including on policy planning, rural development, poverty alleviation, human development, technology, employment, gender issues, regional cooperation, water resources, environment, and climate change. He edits the biannual international journal Asia Pacific Journal on Environment and Development. He was a Coordinating Lead Author of the Intergovernmental Panel on Climate Change (IPCC)-Third Assessment (completed in 2001) and Lead Author for IPCC Fourth Assessment (2004–2007). He has been awarded Ekushey Padak 2009, one of the highest Bangladesh National Civilian Awards, presented by the Government of Bangladesh.



Dr R D Singh has a BE in Civil Engineering and ME in Civil Engineering with specialization in Hydraulics and Irrigation Engineering, from University of Roorkee. He obtained MSc (Hydrology) degree from University College Galway, Ireland. Presently, he is the Director of National Institute of Hydrology, Roorkee. He has research and development experience of more than 29 years in the area of Surface Water Hydrology with special emphasis on flood hydrology and Flood Disaster Management. He has published more than 175 research papers in reputed international and national journals, international and national seminar/symposia, workshops, and so on. He was awarded CBIP Medal for one of his papers presented in the CBIP R & D session. He received certificate of merit for one of his research papers contributed to the Journal of Institution of Engineers. He guided more than twelve ME, MTech, and MPhil dissertations. He is also guiding several PhD scholars. During his service at NIH, he has worked on more than eighteen consultancy projects for solving real life hydrological problems. He has also worked for five international collaborative projects. He is the member of various high-level committees constituted by the Ministry of Water Resources, Department of Science and Technology, Ministry of Environment and Forests, Ministry of Earth Sciences, Ministry of Rural Development, Planning Commission, and other ministries and departments of Govt. of India. He has visited a number of countries, including USA, UK, Ireland, Denmark, Sweden, Holland, France, Germany, and Switzerland.



Dr R K Pachauri is Director-General, TERI; Director of the newly established Yale Climate and Energy Institute (YCEI); and President, TERI North America. He has been the Chairman of Intergovernmental Panel on Climate Change (IPCC) since 2002. He accepted

the Nobel Peace Prize in 2007 on behalf of IPCC, which shared the honour with former Vice President of USA, Mr Al Gore. He has been conferred several awards, including 'Padma Vibhushan' the second highest civilian award in 2008, 'Officier De La Légion D'Honneur' by the Government of France in 2006, and 'Padma Bhushan' in 2001 for his outstanding contribution in the field of science, engineering, and environment. He has recently been bestowed with the 'Commander of the Order of Leopold II' by His Majesty the King of Belgium. He is actively involved in several international forums dealing with climate change policies and has been associated as faculty with academic and research institutions of national and international repute. He has authored 23 books and several papers and articles.



Mr Rakesh Johri is BE (Civil) and ME (Environmental Engineering) and has more than 25 years of experience in the field of Public Health Engineering as well as planning and execution of multidisciplinary projects. He

has executed large-scale water supply schemes and central sewage system, including treatment plant in the Cantonments. He was the environmental advisor to Municipal body of Jullundur Cantonment Board. He prepared 'Training of Trainers' manuals and implemented time-bound water supply projects in rural areas. He planned and implemented Environment Management Plan for small towns in India with special focus on rural sanitation and has published a number of research papers on issues related to water and environment management.



Mr Ravi Narayanan, with degrees in Physics and Engineering from Delhi and Cambridge Universities, has had twenty years experience in the corporate sector in engineering and technology companies in India and the UK and later

twenty five years in the not-for-profit sector, working for

international development organizations and networks. He worked in various capacities as India Director, Director of International Operations, and Asia Director for ActionAid and then as Chief Executive of WaterAid, an international non-governmental organization specializing in water and sanitation programmes in Africa and Asia. At the international level, he is currently a Vice Chair of the Asia Pacific Water Forum, International Mentor to the Japan Water Forum, and Chair of the International Steering Committee of the Water Integrity Network. He was a member of the World Panel on Financing Water Infrastructure (the Camdessus Panel) and the UN Millennium Task Force on Water and Sanitation. He is a life member of the Norwegian Water Academy. At the national level, he was a member of the Technical Expert Group set up by the Government of India to assess its national drinking water mission and is currently member of the National Committee on Monitoring and Evaluation on drinking water programmes and the Twelfth Five-Year Plan Working Group on Water and Sanitation. He is an Associate of the National Institute of Advanced Studies in India. He is an advisor to the Arghyam Foundation, which was recently set up in India to work on sustainable water and sanitation issues in India, a Trustee of the India WASH Forum, the Water and Sanitation Urban Programme, and Gram Vikas. He was awarded an honorary CBE by the UK Government in 2009 for water and sanitation services to poor communities.



Dr R Krishnan specializes in climate modelling to address scientific issues relating to the "Dynamics and variability of the Asian monsoon system". His interests include the phenomenon of monsoon-breaks and droughts; dynamics

of large-scale organization of monsoon convection; and future changes in the Asian monsoon due to global climate change. Dr Krishnan did his PhD research in Atmospheric Sciences at the Physical Research Laboratory, Ahmedabad and was awarded the PhD degree by the University of Pune in 1995. He has more than twenty years of research experience. Dr Krishnan has published over 30 scientific papers in peer-reviewed journals and 20 papers in various research reports. He is actively involved in building human resources for Earth System Science. Currently Dr Krishnan is In-charge of

the Centre for Climate Change Research (CCCR) at the Indian Institute of Tropical Meteorology, Pune and is involved in developing in-house capability in the country in high-resolution Earth System Modelling to address the complex issues of regional climate change over the Asian monsoon region.



Dr Sharad Kumar Jain obtained his doctorate from IIT Roorkee. He has research, development, and teaching experience of more than 29 years in the field of water resources. His research interests include surface water hydrology, water resources planning and management, and application of advanced tools, such as artificial neural networks, remote sensing, GIS, and decision support systems. He is also associated with the work related with International Standards Organization and Indian Standards. He has also handled various administrative duties including the charge of Director (NIH) on different occasions during 2008–09. He is member of the Scientific Steering Committee of the Global Water Systems Project, University of Bonn, Germany. He has been associated with many national committees dealing with various aspects of water resources. He has also authored a range of books and has also contributed chapters in the books.



Dr Shresth Tayal is Associate Fellow with the Water Resources Division, The Energy and Resources Institute, New Delhi and has obtained his doctoral degree on 'Glacier Hydrological Systems' on Gangotri and Dokriani glacier, Garhwal Himalaya, and has been involved in various hydrological, hydrochemical, and meteorological research in glacierized watersheds, and vulnerability assessment of water resources, using hydrological modelling tools at the watershed level. Currently, he is engaged in runoff modeling research for high altitude catchments of Himalayan Rivers based on real time data series for mass balance, energy balance, and hydrological balance of selected glaciated valleys, and quantification of aerosol impacts at the cryospheric regions of Himalaya. With more than 10 years of research experience, he has served Glacier and Climate Change Commission, Government of Sikkim, India as Post Doctoral Fellow and is a member of the Scientific Research Council, Indian Mountaineering Foundation.



Prof. V Srinivas Chary is the Dean of Research and Management Studies at Administrative Staff College of India (ASCI), Hyderabad, India, and specializes in governance, institutional reforms, and capacity building for improvements in urban service delivery. He has over 20 years of professional experience in the areas of urban infrastructure and service delivery and extensively worked on 24x7 water supply, urban sanitation, PPP, and pro-poor strategies. An engineer, urban planner, and management professional by training, Prof. Chary, prior to joining ASCI, was a Senior Faculty at the Environment Protection Training and Research Institute (EPTRI), Hyderabad and at The Energy and Resources Institute (TERI), New Delhi. Prof. Chary has led over 130 advisory, consulting, and research assignments both in India and South Asia. He has conceptualized and implemented structured capacity building programmes for elected representatives, officers of the Administrative Service, and urban sector professionals in India and abroad. Prof. Chary was also instrumental in establishing the Urban Resource Link—a unique model of knowledge support for cities and water utilities, the Change Management Forum, which facilitates peer learning amongst a network of municipal officers and elected representatives. He facilitates the National Urban Water Awards to recognize excellence in urban water management for water utilities and municipalities in India. As a member of the urban sanitation taskforce of the MoUD, he played a catalytic role in the formulation of the National Urban Sanitation Policy of the Government of India. Prof. Chary assists the Ministry of Urban Development by undertaking independent appraisal of city development plans and reforms implementation under the Jawaharlal Nehru Urban Renewal Mission. He was professionally affiliated to the University of Pennsylvania, Philadelphia, University of Bradford, UK, University of Manchester, UK, and Water Engineering Development Centre, UK. He is also a Chevening fellow. Prof. Chary published over 30 papers in national and international professional journals. He was conferred an Ashoka Fellowship for promoting continuous (24x7) water supply. He is passionately committed to capacity building with the objective of ensuring continuous water supply and open defecation-free urban systems in India.



Mr Jadhav is an agricultural engineer with 22 years experience in the irrigation sector in general and micro irrigation in particular. He has been working with Jain Irrigation since last 18 years in different capacities. He has also worked

with other private sector companies. His area of expertise is micro irrigation projects. He is engaged in survey, design, installation of micro irrigation projects, and water management projects, including drip and sprinkler irrigation of large sizes. He also has exposure in farm development projects. He has designed many large sized on- field piping networks and lift irrigation projects. Since the last couple of years, he has been heading the “On Demand Irrigation Division” of Jain Irrigation. “On Demand Irrigation “of JISL is a division engaged in execution of Canal Command Micro Irrigation Projects in the country.



Mr Tim Kasten is Deputy Director of UNEP’s Division of Environmental Policy Implementation. He is also Coordinator of UNEP’s Freshwater and Terrestrial Ecosystems Branch and Coordinator of UNEP’s Climate Change

Adaptation Unit. He has served UNEP for 13 years in both Kingston, Jamaica as marine pollution coordinator and now in Nairobi, Kenya. Mr Kasten also served 12 years with the US Environmental Protection Agency’s Office of Water. His undergraduate work in biology was followed by graduate studies in environmental resource management and public administration focusing on science and public policy. In addition to his work with UNEP, he currently serves as the Vice-Chair of UN-Water.



Mr Timothy Neely currently serves as the Chief for the Environment, Science and Technology Affairs, Office of the American Embassy in New Delhi, India. His date of arrival to post was 30 July 2010. Mr Neely’s hometown is Iloilo City,

Philippines. Although educated mainly in the USA, he attended high school at the Central Philippine University in Iloilo City. Mr Neely holds an MA in International Affairs and an MBA, both from Ohio University. He has been a member of the United States Foreign Service

since 1987. Before joining the Foreign Service he served as a math and science teacher for the US Peace Corps in Africa, and worked in contracting for the US Marine Corps. His prior Foreign Service postings and positions held are as follows: Manila (Econ Deputy), Taipei (Econ Deputy), EAP/EP, Beijing, Kaohsiung, EB/TEX, Guangzhou. His professional interests include science and history.



Dr Tushaar Shah, an economist and public policy specialist, is a former director of the Institute of Rural Management at Anand in India. Dr Shah obtained his Doctorate from Indian Institute of Management

Ahmedabad, India in the field of Management and Economic Analysis. Over the past 30 years, Shah’s main research interests have been in water institutions and policies in South Asia, a subject on which he has published extensively. He has consulted with a wide range of institutions, such as the Government of India and the Swiss Development Corporation, New Delhi, Ford Foundation, The Sir Ratan Tata Trust, Mumbai, and several others. His notable contributions have been in comparative analyses of groundwater governance in South Asia, China, and Mexico. More recently, his interests lie in comparative analyses of water institutions and policies across Asia and between South Asia and Sub-Saharan Africa. Shah was honoured with the Outstanding Scientist award of the Consultative Group of International Agricultural Research (CGIAR) in 2002. His most recent publication is Taming the Anarchy: groundwater governance in South Asia published by the Resources for the Future Press, Washington. Dr Shah is a Senior Fellow of the Colombo-based International Water Management Institute, and works out of Anand in western India.



Mr T M Vijay Bhaskar, is the Joint Secretary at Department of Drinking Water and Sanitation, Ministry of Rural Development, Government of India. He did his Masters in Economics in 1983 and after that joined the Indian

Administrative Services. He has served at various departments of Government of India, which include Revenue Department, Govt. of Karnataka; Public Works,

CADA and Electricity Department, Govt. of Karnataka; Housing and Urban Development, Govt. of Karnataka; Zilla Parishad, Rural Development and Panchayat Raj, Govt. of Karnataka; Department of Women and Child Development, Ministry of Human Resource Development; Higher Education, Govt. of Karnataka; Watershed Development, Agriculture and Horticulture Department, Govt. of Karnataka; Heritage, Archaeology and Museums, Department of Kannada and Culture Department, Govt. of Karnataka.



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Dr Yoginder K Alagh, is currently Chancellor, Nagaland University, Chairman, IRMA, and Vice Chairman, Sardar Patel Institute of Economic and Social Research, Ahmedabad. He is a Trustee of the Rajiv Gandhi Foundation.

He was earlier Minister of Power and Planning and Programme Implementation with additional charge of the Ministry of Science & Technology. He has been Member, Planning Commission (in the rank of Minister of State) and Vice Chancellor of the Jawaharlal Nehru University. He has been Chairman, Bureau of Industrial Costs and Prices, Ministry of Industry and Secretary to the Government of India. He is Chairman of the Managing Board of South Asia Network of Development

Economists (SANDEE) located at ICIMOD, Kathmandu, Senior Fellow at CIGI, Waterloo, Canada and a member of the DEFINE Network of the OECD. He holds a Doctoral degree in Economics from the University of Pennsylvania and Master's degree in the same subject from that University and the University of Rajasthan. He has taught Economics at the University of Rajasthan, Indian Institute of Management, Calcutta, University of Jodhpur, Swarthmore College, the University of Pennsylvania and was Senior Fellow at World Institute of Development Economics Research (WIDER), Helsinki. He has seven books and over a hundred articles to his credit, published both at home and abroad. He has travelled widely and represented India in a number of high-level official delegations and seminars. He was Member of the Council, United Nations University, and Chairman, Scientific Steering Committee of the International Social Science Programme of UNESCO. He has been Distinguished Fulbright Fellow in the US, Visiting Professor at the Sc.Po in Paris and Distinguished Shastri Lecturer in Canada. He has been Chairman/member of a number of official committees at the state/national level and has been consultant/senior adviser to the FAO, ILO, UNDP, ADB, UNFPA, and World Bank. He is an independent member of the board of Tata Chemicals, Shree Cements, and Somany Ceramics. He has been awarded the VKRV Rao Award in Economics for 1981. Prior to the charges as the Union Minister of State (Independent Charge), he was Vice Chancellor, Jawaharlal Nehru University and was Senior Fellow, World Institute of Development Economic Research, United Nations University, Helsinki. He is President of the Human Development Institute, Giri Institute of Development Studies, Lucknow, Institute of Development Studies, Chandigarh, the Advisory Committee of the NM Sadguru Water Development Trust, Dahod, and Shirdi Sai Rural Institute, Loni. He chaired the Expert Group of Cauvery Dispute, constituted by the Prime Minister of India, and was Consultant to the Mekong River Commission. He is Senior Fellow of CIGI in Canada, Fellow, National Academy of Agricultural Sciences, Delhi, and the World Innovation Foundation, UK. He writes a column for the Express group.

SPEECH OF INAUGURAL SESSION

HIS EXCELLENCY HON'BLE VICE PRESIDENT OF INDIA

SHRI M. HAMID ANSARI

INAUGURATED THE INDIA WATER FORUM 2011



Dr. Farooq Abdullah Saab, Dr. Salman Khurshid Saab, Dr. Pachauri, Dr. Rakesh Johri, Excellencies distinguished guests and ladies and gentlemen. The Energy and Research Institute (TERI) has formidable reputation. And I am happy to participate in today's function organized in association with Ministry of Water Resources Government of India. It is very appropriate that the theme of the first IWF is the challenges and opportunities of dealing with the twin issues of water security and climate change.

Further it is essential building bloc of existence would be unimaginable and a Urdu poet summed up the human sentiments above this. Beautiful is the world for the water – fair and love. If there is paradise than this indeed it is.

Now the world over today water is the critical national hazard with geo political and geo strategic important. The water resources often transcends national boundaries successful public policies therefore has to be advanced on establishing cooperative partnerships between governments business and industry- non governmental and civil society organizations and above all the individual groups.

Further management systems have traditionally reflected existing socio economic structures and governance mechanisms. The key challenges for water management today scam probes (phonetic) changing demographics shifting geopolitics wide spread poverty and other developments – climate change phenomenon and shifting weather patterns and elements of globalization and its pretended competencies.

Probes formulating public policy regarding these vital resources must therefore cater to essential requirements and ensure sustainability of eco systems so that there is availability of adequate water to meet the demand. Prevention of greed from waste and conspicuous consumption must be made higher relatively.

At the outset it would be useful to look at some figures regarding our models. India has 2.3% of the world's area and 16% of the world's population but only 4% of the total available fresh water. Our main water resources consists of an annual precipitation of around 4000 cubic km and a broad estimate of trans- boundary close to upper riparian neighbours or around 500 cubic km. the total precipitation annual availability from surface and ground water is estimated at 1869 cubic km.

However only 60% of this at 1123 cubic km is estimated to be capable of being put to beneficial use. And 690 cubic km of which surface water and 430 cubic km being replenishable ground water. The twin indicators of water scarcity are per capita availability and storage. Our population has increased from 361 million in 1951 to 1.21 billion in 2011. Accordingly the per capita availability of water for the country as a whole has decreased from 5177 cubic m per annum in 1951 to 1544 cubic meters per annum in 2011. In other words drastic reduction of 70% in 60 years.

This meets the definition of a water stressed conditions which is per capita availability of less than 1700 cubic meters. The situation is even more serious when we look at individual river basins. Five out of 20



river basins in the country with population of about over 200 million meet the definition of water scarcity of per capita availability of less than 1000 cubic meters.

In the way no better regarding the other indicators of storage- according to 11th FYP documents per capita for the storage in the country is 213 cubic meters as against 6000 in Russia, 4700 in Australia, 1100 in China and 1960 in USA. It is estimated by the year 2050 as per existing water use practices overall demand for water resources would be 1447 cubic km around 30% higher than the assessed utilizable water of 1123 cubic meters.

It is evident that only the adoption of better governance practices enhance the efficiency would reduce this demand. The annual extraction of ground water in India at 210 cubic kilo meters is the highest in the world. It provides for over 60% of net irrigated area and has accounted for over 85% of the addition to the irrigated area in the last decade. The growing dependence of ground water has been at the cost of unsustainable over-extraction in at least 3rd of the total area and population of the country. This has lowered the water table and adversely impacted the rural drinking water.

For example in six year period the ground water depletion in Rajasthan Punjab Haryana and Delhi was 109 cubic km double the capacity of India's largest surface water dependence.

Finally we must know that irrigation accounts for 85% of water requirement whereas drinking water accounts for 7% with industrial energy and other uses being in

smaller scale. This data makes disturbing scenario and it suggests that analysis and policies regarding irrigation is central to sustainable water.

Friends, the picture of water scarcity across the country is indeed one of the major concerns. Water availability and water quality issues make the majority of citizens involved in rural and urban areas. Gross irrigated areas are not really commensurate with our group investments with the act between potential created precipitations and potential that is actually invested.

The problems of floods has been exasperated due to degradation of scarcity of catchments area and lost of flood based to urban development mechanisms. Water conflict has taken new form with more consequences. Climate change issues have further complicated the water problems and it is likely to alter precipitations received in our country's hydrological catchments upper riparian neighbours. And countries and distribution and quality of water resources in the country.

The threats and challenges are significant and major. We had recognized and responded to the threat of water insecurity emanating from climate change. The National Water Mission have been established under the National Action Plan for Climate Change (NAPCC) for the conservation of water with minimizing the wastage and ensure it is more suitable distribution both across and within states so integrated water resources development and management.

I suggest specific action points and sought policy modifications in view for climate change concerns. First it has sought comprehensive reforms on regulation of water resources. Such public regulation must ensure that the right of the citizens and residents to minimum essential water supplies for health and hygiene is restored. And available water is equitably distributed across regions and categories of users.

Monitoring is done to ensure compliance with allocation and water problem. That there is creation review and modification of water rights for various categories of users. Create water prices for different users and create the system of penalty for polluting surface and ground water.

Second policy planning must consider jotter as a unified resource with the quantified hydraulic cycle becoming main tool for understanding the water situation. And rainwater and evaporation should submit current strategies of managing rivers and aquifers. Thus water balances water distributing water accounting and water audit should be based on the hydraulic cycles and the interaction between the rain water surface water ground water and river water.

Third there is need to establish and legally empower stakeholders manage basin authority with wide paths for approving development and management plans entitling emergencies. And the task with reducing conflicts and imposing penalties for misuse of water resources. Fourth – in proving water use efficiency in irrigation is critical for water management. For each part of irrigation area benchmarking and performance evaluation studies for each water areas will complete problem.

And efficiency should be put in the public domain for transparency and accountability. Subsidy should encourage irrigation efficiencies through constructing storage facilities for irrigated water and users.

Participatory management of irrigation system would increase equally and reliability and reduce process use over irrigation. And Fifth we need to launch coordinated

and time bound program to improve the analytical capability of our resource personnel in various public and private agencies at the national stage and local governments agencies.

Ladies and gentlemen I fear that in regard to water we are living in the past and too many of us take water to plant. By climate change the idea of water scarcity must be seen in the full consciousness and through it through its institutional mechanism of global and constitutional and national governance and business and industry. The need to address the complexity of the water management in the context of climate change is felt.

Water shortages affects the most unreliable industry for example today water shortage at high water temperatures in the year 2003 in France net to shut down or steering down the production and its nuclear power stations responsible for supplying over 75% of total electricity. The nations and we too ration the use of water from industry purchasing and pricing such use that there would be significant changes in the business environment.

Water stress and scarcity would have significant impact on the prospect of Indian industry operating in various sectors including agriculture and agro industries irrigation mining pulp and paper, iron and steel and power generation. Regulators investors and citizens alike must demand corporate water disclosures including plans and policies with water consumption use and disposals and whether environmental concerns have been addressed.

Today's convention I venture to hope would contribute to the realization that water scarcity affects individuals businesses and the national economy – water is central to the poverty alleviation and citizens empowerment and better water governance is shared enterprise would be all stakeholders citizens government civil societies and industries. Thank you Dr. Pachauri for inviting me to inaugurate this conference and I wish all success in your endeavor. Jai Hind.



SPEECH OF INAUGURAL SESSION

Hon'ble Minister for Water Resources, Government of India - **Mr. Salman Khursheed**

Honorable Vice President of India, I'm extremely honored and privileged from the remarkable comprehensive statement on water management. Dr. Pachauri Dr. Leena Shrivastav Prof. Jaitley my colleague Dr. Farooq Abdullah for shifted this position after which I spoke. Ladies and gentlemen it is indeed pleasures as well as great honor to have such distinguished gatherings here this morning. I do convey my regret for my later arrival. And it is very difficult to explain to people who voted to me that despite being little coordination that much I can do. We can ensure that water close down from the river and towns and canals.

But the municipality to the last mile of the canal of by delivery and indeed the hand pump that are being provided pipe water has been provided. So different departments and departments of GoI the department eight state governments and that is essentially major may be the capacity we have in our country. We all know the seriousness of water crisis which is we can do something. And we have been confident over this which is something but still some distance away.

But critical issues for us are not just scientific approaches and the managerial approaches with for our water in this country where we have just been told we have serious concern over them we have background. And several areas are largely in our neighborhood countries we talk to them, about Indian situation which both sides will stands with certificates.

But there are political corporations and political conspirations that had to be dealt and defend by all the

governments. We also have revised basis of framework where major issues of population and meets the land and therefore lot of power that needs constant patronage and support. There are people who still talk about and must have already talked about leading the candles but we also know the country's rivers will have implications.

The other problem which is being faced by us ground work has been carried out and we have presently just in the process of mapping all our underground aquifers and we haven't been sorted and updated about deaquifers which I would imagine it had been given some time for us and that is something perhaps in the whole infrastructural and trusted generations to come. We have technology but still we don't have clarity. Do we have the moral right and are we scientifically take on civil round if we gently start which is quite comfortable.

These are some of the problems that stands of problem that we have essentially as for as India is concerned. Our problems are of federations we do not have reached the level of prices in which we will have the advancement of the problem. And the Australian states providing more information and there was no other choice of change of belt. And we have fortunately – resettled and we resettled in Economics when Dr. Man Mohan Singh was finance minister. We had to choose major economic issues in this context.

First generation of economics we have gone through and we were hoping the second and third generation will show more interest but obviously that obviously that has not happened. There are hydrological implications

there are serious difference of opinion and so there is slow down of opinion and they can get along with the consensus very well that is taken over in ten years from us. But that cannot happen as for as time change is concerned it has not happened.

Of course the ideal thing would be to us would be to able make the migrate of aprons and structures concerned and so life structure of the animals we now having to be bogged down by the prices. One of the things that we need to do – we need to do either to do parliamentary proceedings- legislations we need to explore such authority- empower available under the constitution of central government to reach out to larger area of inner-state management of water.

They limited the query limited this and defend from conflict and left this entirely to state government obligation. That is limited area to which central government has responsibility and till such time further registration is not possible.

The other issue of course is the large issuer is of central state relations and again this is controversial and sensitive issue. And they are permitted to provide an equivocal program expeditiously. And today large water management needs support from states but financing of water management is not permissible under the statutory restrictions.

When we talk of transferring surplus water from surplus region through deficit regions something that we have talked about large part of the century but something of the issue that we will be able to reach out and bring forth which is smaller changes matter and only thing to do is actually transferring water from one from one place to another region. And then we also have kind of structure. And what type of the structure is required to be able to do so. And transferring water from surplus region to deficit region we obviously involve very tough decisions as for as the ecology is concerned.

And ultimately the space or place for crop for allocations system as such and the same issue that comes up every time we talk about storage despite limited storage and the same issue that will come to the fore once again when we talk of transferring water from surface region to bracket region. We have short small range of this and we just beginning to work on that which is the inter-river transfer they transfer from one river to another river or from one region to another region. But intra-state

transfer rather than interstate transfer and even there we face enormous difficulties for transfer.

The broad packed off given the entire drop and challenges we face and commitments we have and action plan on climate change water issue is significant part of water missionary. I wish to give you the news which very recently as 6th of April the government has finally approved the Water Bill. Through the First FYP Plan throughout the 3rd FYP this will be major step in this direction.

Next year we will also move forward to new water policy and main thrust here indicated here is increasing water efficiency for which we will soon have Water Act and we are looking at by the year 2020. And we are looking at arbitration in water efficiency and quality and its use in agriculture etc. And the ministry gets its role in agriculture also recycling of waste water – today only 30% of waste water will actually get recycled. It is very major problem and sometime it lead to crisis and it is very difficult to handle the crisis.

We also have very little yet on our side as for as recharge of the ground water is concerned. There are civil societies to deal this problem and will focus in the next five or ten years Delhi will become the water centre for recharged water by citizens of Delhi using the rainwater. Essentially we need some active attitude in the whole country and there aquifer changes have to be more than this kind of looking.

And this is my concern and also this is not my concern but we still have to see in this spirit which incorporates the same as indicated in the pink color but all the natural problems must be seen. But in the modern jurisprudence given by Sudip Kaur which lie heavily upon this and therefore water is now see as object and trusty ship of the nation for both entire people state and for generations to come.

The moment we begin to accept that water is trusted by our generation both for metropolitan and citizen as for as global citizen. And this will apply down to the grass root level.

Today the person who wants broader land has assumed and has rightly so that the water exists below the irrigable land. And we according to political compulsions key back persons and key electricity will come through. Now we have to stop electricity to begin with and we had to ensure the cropping pattern and demand for water also regulated.



And finally we have to persuade that persons in the water we know the soil is not the requirement of water for any type of community so that the entire region will be water free and the crop pattern will take up and take route in that very soil. This is something that that will require national educational processing. Today we need more action from the government side but there is no delivery of water but we not find elections on scarcity of water.

Everybody assume today that it is only because our efficiency of infrastructure and lack of care no body is willing to believe that this is just simply a forum and we will have to deal with in terms of massive activity for the country and how we will look at one sects we are coping up with for long time. And perception must now b transformed change and develop into photo stat type of instrument of management of water in our country.

As I said earlier we will face on which we are actively working we had talk with engineers' scientists' technocrats and community people on this matter. We will have to look at and do something on exports we will

have to do something for Punjab and motivating people from switching to high consuming water places and this will lead major transformation in the field of agriculture and economics of agriculture. And to get the financial support and this year we had highest agriculture yields and our efforts were successful. So we look at the production of agriculture we also focus our attention on the types of fertilizer manures for the agriculture. So there are these issues. But what we require at this moment is reuse of water to overcome water shortage.

And making more innovative research to find long lasting solutions for farmers in order to reap high yields and also moving towards self sufficiency in the field of food security and also to some water security. We are lucky to have a person at the helm of affairs in the highest office our Honorable Vice President Mohd Hamid Ansari who will lead the country and take this step of water security forward by not only assuring some relief and enable the farmers peasants to attain high yields productive yields of various crops which is the ultimate purpose of our government. Thank you very much.



SPEECH OF INAUGURAL SESSION

HON'BLE MINISTER OF MINISTRY OF NEW AND
RENEWABLE ENERGY RESOURCES
– **MR. FAROOQ ABDULLAH**



Honorable Janaab VP Mohd. Hamid Ansari Sahib, Dr. Salman Khurshid Sahib, Dr. Pachauri, Dr. Johri, Excellencies and distinguished guests ladies and gentlemen. I am very grateful to Dr. Pachauri and Mr. Johri for holding this meeting here. Because water is vital issue. It is very appropriate that the theme of this first international convention is challenges and opportunities of dealing with issues of water security and climate change. Water is an essential building bloc of life and its existence would be unimaginable.

An Urdu poet summed up the vital issue of water. One day we will be on progress to achieve some success on water issue- one day we shall have dams and canals and one day we shall have pipelines to bring water – as we need water -what will happen one day if we do not mend our ways? We don't have any alternative to use water as we like it and we don't want then let us waste the water. If Vice President will permit me I will few words.- the truth is population is growing at geometrical speed and I don't know whether the time will come when all these proved to be waste.

And without water we cannot live for few hours. Dr. Pachauri say our glaciers are sick and melting. People laughed for this. What did he say? We have massive glaciers. I have seen cloud bursts and glaciers are really melting and converting into water and drying down. That mighty River Jhelum is the lifeline of Jammu and Kashmir. That mighty river has become slowly trickling

down. All these things I have seen in my own naked eyes.

And I see how our community and army community still not capable of using the water from here. In Israel the situation is very warranted and piquant there. And then in Maharashtra also the same situation- we are wasting lot of water for irrigation and other industrial purposes. And we are running short of energy also. That also we must have to realize. You can help in generating electricity – energy we shall be of healthy energy generator. You had seen the driver of life is energy to some extent and without energy we cannot extract water, we cannot use appliances, and we cannot prepare food and other necessities.

In Japan they were very advanced in this matter but every thing had gone out of gear due to devastating earthquake. The only solution as our Honorable Vice President said that in France the reactors could not be cooled and therefore the reactors have been shed down. Environment is undergoing vast change massively affecting all the issues of natural resources. Are you reading newspapers where Japan is making its efforts to save the reactors to produce energy in bulk quantity?

Why this is going on? And with this you wake up and this is the job that needs to be known by all. What do we do? To save the world from disasters that is looking into our life. It is high time we have to recognize and take adequate and right steps which will help us in saving not only India but also the world. But my initial response

was South Africa – very developing nation- energy crisis- water crisis and therefore what you say here will not actually good for us but good for many reasons. And therefore world survives.

Our Prime Minister emphasized for many forms of renewable energy which are easily accessible and implementable such as Photo Voltaic, solar energy, wind energy thermal energy, hydel energy. And of which solar energy is expensive – but I'm confident over the year national consumers of energy and rural manufacturers will prefer and start consuming renewable form of energy which would be expensive but there is other alternative.

We are still first generation as for as the oil and fuels are concerned and where nations control put their hands together it would be easy to generate the required amount of energy because now it is possible only with the help of the government. And anyway the matter of fossils this year and any body can change this. We should make all the efforts towards self sufficiency and also self reliance so that we can change the horizon or scenario and thereby farming community can be helped with adequate financial assistance and other raw materials or resources.

The ground water table is depleting day by day and many industrial townships and farm houses are constructed but there is crisis for power supply. Now the government of India had stopped and put restrictions to dig the ground beyond certain level through statutory rules and regulations in Gurgaon- which is very much near to New Delhi –situated under National Capital Region of Delhi (NCR).

Even National Monument TAJ MAHAL (one of the 7 Wonders of the world) is in danger for its environmental pollution because of Water. Because there are various industrial plants and factories are mushrooming and already started to operate from the surrounding vicinity of

TAJ MAHAL. Anybody from SAARC is familiar about the world's environmental hazardness. And Dr. Pachauri is also familiar about SAARC countries and knows water crisis all over the world. We can have the consensus – where do we and why do we help each other?

We have the bigger and bigger rivers all over our country. We have the big river Bramha Putra – to which Chinese were constructed something in that area. I hope they would overcome the crisis and scarcity and will save the precious water from minimizing the water consumption. First of all we have to overcome the misunderstanding on the sea level rise and also temperature rise of the sea level.

Keep on telling everyone wherever we are and wherever you are and wherever you are consuming the water. Now we want everybody should impose self restriction on themselves not to use water lavishly but to minimize the water wastage which is precious lifeline. Not only we have to minimize the water consumption but also we have to minimize the energy consumption. I am grateful if people will be aware of the possible disasters that may erupt in the years to come. If this will be followed definitely I am sure things will get changed automatically.

In my own company I myself will work on natural set up and sit in my work for an hour. I will minimize the power consumption and read the books in broader day light and also use minimized water for drinking. How can there be better farming- it is due to extensive use of water. But there should be some research studies so as to know any crop that needs minimum water requirement and within that high yielding. Similarly water is also being used for washing but there also some restrictions have to be self imposed so that from our part we can minimize the water usage. In this direction we have to work and GOD bless you all. THANK YOU.

SPONSOR'S PROFILE



MINISTRY OF WATER RESOURCES (MOWR)

The Ministry of Water Resources, a branch of the Government of India, is the apex body for formulation and administration of the rules and regulations and laws relating to the development and regulation of the water resources in India. The Ministry looks into the overall planning, policy formulation, coordination, and guidance in the water resources sector. It provides technical guidance, scrutiny, clearance, and monitoring of the irrigation, flood control, and multi-purpose projects (major/medium) along with general infrastructural, technical, and research support for sectoral development. It provides special Central financial assistance for specific projects and assistance in obtaining external finance from World Bank and other agencies. The Ministry also looks into overall policy formulation, planning, and guidance in respect of minor irrigation and command area development, administration, and monitoring of the Centrally Sponsored Schemes and promotion of participatory irrigation management. It looks into planning for the development of groundwater resources, establishment of utilizable resources and formulation of policies of exploitation, overseeing of and support to state-level activities in groundwater development. It is responsible for formulation of national water development perspective and the determination of the water balance of different basins/sub-basins for consideration of possibilities of inter-basin transfers. It coordinates, mediates, and facilitates the resolution of differences or disputes relating to inter-state rivers and in some instances, the overseeing of the implementation of inter-state projects. It also looks into operation of the central network for flood forecasting and warning on inter-state rivers, the provision of central assistance for some State Schemes in special cases and preparation of flood control master plans for the Ganga and the Brahmaputra. The Ministry carries out talks and negotiations with neighbouring countries, with regard to

river waters, water resources development projects, and the operation of the Indus Water Treaty.

DEPARTMENT OF SCIENCE & TECHNOLOGY (DST)

Department of Science and Technology was formed in 1971 under the Ministry of Science and Technology and is a nodal department for organizing, coordinating, and promoting scientific and technological activities in the country. Their objective is to promote new areas of science and technology. The major responsibilities of DST include, formulation of policies, sponsoring scientific and technological surveys, promoting research and development at grass-root level viz., state, district, and village level. One of the scientific programmes of DST includes Water Technology Initiative Programme, which aims to provide drinking water in terms of adequate quantity and quality at an affordable cost with the help of suitable science and technological interventions. Their focus is to provide holistic solutions to solve the problem of water contamination and water scarcity. The outcome of their programme intends to deliver tangible benefits to the common people.

DEPARTMENT OF DRINKING WATER SUPPLY (DDWS)

The provision of drinking water supply and extension of sanitation facilities to the rural poor are the main components of the activities of the Department of Drinking Water Supply. The major programmes of the DDWS are the Swajaldhara, the Accelerated Rural Water Supply Programme (ARWSP), and the Total Sanitation Campaign (TSC). The department comes under the Ministry of Rural Development. The ARWSP was introduced in 1972–73 by the Government of India to assist the States and Union Territories to accelerate the pace of coverage of drinking water supply. The entire programme was given a mission approach with the launch of the Technology Mission on



Drinking Water and Related Water Management in 1986. Later in 1999, Department of Drinking Water Supply was formed to give more emphasis on Rural Water Supply programme. Total Sanitation Campaign is a comprehensive programme to ensure sanitation facilities in rural areas with broader goal to eradicate the practice of open defecation. TSC as a part of reform principles was initiated in 1999 when Central Rural Sanitation Programme was restructured making it demand driven and people centered. It follows a principle of “low to no subsidy” where a nominal subsidy in the form of incentive is given to rural poor households for construction of toilets. Research & Development in the field of Rural Water Supply and Sanitation programme is one of the support activities of the DDWS for which 100% funding to research organizations, including NGOs is given by the Central Government.

MINISTRY OF RURAL DEVELOPMENT

This Ministry has been acting as a catalyst effecting change in rural areas through the implementation of a wide spectrum of programmes, which are aimed at poverty alleviation, employment generation, infrastructure development, and social security. This Ministry’s main objective is to alleviate rural poverty and ensure improved quality of life for the rural population especially those below the poverty line. These objectives are achieved through formulation, development, and implementation of programmes relating to various spheres of rural life and activities, from income generation to environmental replenishment.

The Ministry consists of the following Departments.

1. Department of Rural Development
2. Department of Land Resources
3. Department of Drinking Water Supply

The Department of Rural Development implements schemes for generation of self employment and wage employment, provision of housing and minor irrigation assets to the rural poor, social assistance to the destitute and rural roads. Apart from this, the Department provides the support services and other quality inputs, such as assistance for strengthening of DRDA Administration, Panchayati raj institutions, training & research, human resource development, and development of voluntary action for the proper implementation of the programmes. The major programmes of the Department of Rural Development are Pradhan Mantri Gram Sadak Yojana, (PMGSY), Rural Housing (RH) Sampoorna Gramin Rozgar Yojana (SGRY), and Swarnajayanti Gram Swarozgar Yojana (SGSY).

Department of Land Resources implements schemes to increase the biomass production by developing wastelands in the country. Department also provides the support services and other quality inputs, such as land reforms, betterment of revenue system, and land records. It also

undertakes development of desert areas and drought prone areas in the country. The major programmes of the Department of Land Resources are Drought Prone Area Programme (DPAP), The Desert Development Programme (DDP), the Integrated Wasteland Development Programme (IWDP), and Land Reforms (LR). These aim at increasing the soil and moisture conservation and productivity of the wasteland of the degraded lands, thereby increasing the income of the people.

The provision of Drinking Water Supply and extension of Sanitation facilities to the rural poor are the main components of the activities of the Department of Drinking Water Supply. The major programmes of the Drinking Water Supply Department are Swajaldhara, the Accelerated Rural Water Supply Programme (ARWSP), and the Total Sanitation Programme (TSP).

AUSAID

The Australian Agency for International Development (AusAID) is the Australian Government agency responsible for managing Australia’s overseas aid programme. AusAID is an Executive Agency within the Foreign Affairs and Trade portfolio and reports to the Minister for Foreign Affairs. The objective of the Australian aid programme is to assist developing countries reduce poverty and achieve sustainable development, in line with Australia’s national interest. AusAID provides advice and support to the Minister for Foreign Affairs on development policy, and plans and coordinates poverty reduction activities in partnership with developing countries. AusAID leads and coordinates Australia’s responses to humanitarian and disaster-related crises and represents Australia in international development forums. AusAID is strongly committed to evaluating and improving Australia’s aid programme and to collecting, analyzing, and publishing development data and other information. AusAID’s head office is in Canberra. AusAID also has representatives in 37 Australian diplomatic missions. AusAID started in 1974 and was originally known as the Australian Development Assistance Agency (ADAA).

COCA-COLA IN INDIA

The Coca-Cola Company is the world’s largest beverage company. Along with Coca-Cola, recognized as the world’s most-valuable brand, the Company markets four of the world’s top five soft drink brands, including Diet Coke, Fanta, and Sprite and a wide range of other beverages, including diet and light soft drinks, water, juices and juice drinks, tea, coffee, and sports drinks. Through the world’s largest beverage distribution system, consumers in more than 200 countries enjoy the Company’s beverages at a rate exceeding 1.6 billion servings each day.

Coca-Cola in India is the country's leading beverage Company with an unmatched portfolio of beverages. The Company manufactures and markets leading beverage brands like Coca-Cola, Thums Up, Fanta, Limca, Sprite, Maaza, Maaza Milky Delite, Minute Maid, Nimbu Fresh and Pulpy Orange, Burn, Kinley, Nestea, and Georgia range of tea and coffee.

One of the early investors in India, the Coca-Cola system provides direct and indirect employment to more than 150,000 people. The Company has more than 1.3 million retailers and our business has a multiplier effect on employment and earning opportunities. Coca-Cola in India is the largest domestic buyer of sugar and one of the top buyers of mango pulp. The Company's business also positively impacts industries like Glass, Plastics, Resin Manufacturers, Sugar, Automobiles, White Goods Manufacturers, and Banking.

The Coca-Cola Company has always placed high value on good citizenship. At the heart of business is a mission statement called the Coca-Cola Promise—"The Coca-Cola Company exists to benefit and refresh everyone that it touches." This basic proposition entails that the Company's business should refresh the markets, protect, preserve, and enhance the environment and strengthen the community. Coca-Cola India provides extensive support for community programmes across the country, with a focus on education, health, and water conservation. The Company has commissioned 600 rainwater harvesting structures in the country. The Company has also undertaken the rejuvenation and reconstruction of several traditional water bodies, including check dams. We are also working towards providing clean drinking water to school children in Chennai and areas in West Bengal in partnership with Rotary International and UN Habitat respectively. The Company is committed to working with communities across India in its effort to contribute to mutual growth and development.

HINDUSTAN CONSTRUCTION CO. LTD

HCC is an integrated group spanning Engineering and Construction, Real Estate, Infrastructure, and Urban development and Management. The HCC group of companies comprises HCC Ltd, and its subsidiaries HCC Real Estate Ltd, HCC Infrastructure Ltd, Lavasa Corporation Ltd, and Karl Steiner AG, a recent acquisition in Switzerland.

Founded by Industrialist Seth Walchand Hirachand in 1926, HCC today commands high respect amongst its clients, partners, and industry leaders, having executed a majority of India's most challenging infrastructure projects. The Company has constructed more than 25% of India's hydro power and over 50% of India's nuclear power

generation capacities, built close to 10% of India's highways under the national highway development programme, and bridged almost every major river in the country. Projects executed across India bear HCC's hallmark of world-class innovation, from Roads & Expressways, Tunnels, Bridges, Dams and Barrages, to India's first and longest open sea Cable-Stayed Bridge in the country's commercial capital, Mumbai.

Being the first construction company in India to establish and implement ISO certified Quality, Occupational Health and Safety, and Environment management systems and robust Corporate Governance norms, HCC has also achieved the fastest implementation of SAP-ERP across all its diverse project construction locations, even at record breaking altitudes of over 11,000 feet in the Himalayan ranges.

By investing in a fleet of ultra-modern equipment in an otherwise labour-intensive sector, and by joining hands with international construction majors to form tactical joint ventures, HCC has ensured the speedy adaptation of the latest technologies and construction techniques for its projects. HCC's turnover over the last 5 years grew at an impressive CAGR of 17 % and the order book as of March 2010 was Rs 18,810 crore (\$4.18 billion).

Corporate Responsibility remains intrinsic to HCC, encompassing HIV, Education, Water, and Disaster Management initiatives. With a view to creating greater AIDS awareness in the industry, the company has been instrumental in launching a Work Place Intervention (WPI) programme, covering over 45,129 construction workers across HCC's countrywide project locations.

In line with HCC's commitment to make water sustainability and stewardship a corporate priority, its Chairman and Managing Director Mr Ajit Gulabchand is the first Indian signatory as well as amongst the first few globally, to endorse the United Nations CEO Water Mandate. Mr Gulabchand was Co-Chair of the World Economic forum's (WEF) India Economic Summit 2010 and has Chaired the Governor's steering board and the Engineering & Construction Community at the World Economic Forum's Annual Meeting 2011 in Davos. He is also an Executive Committee member of The Energy and Resources Institute (TERI)-Business Council for Sustainable Development.

HCC's most important asset is its talented manpower, which is committed to construction standards of the highest quality. The group has a knowledge asset of more than 3,000 officers, including approximately 2,000 engineers; and employs more than 35,000 workers at its 50 project sites across India.



OXFAM INDIA

Oxfam is a vibrant global movement of passionate, dedicated people fighting poverty together. Doing amazing work, together. People power drives everything we do. From saving lives and developing projects that put poor people in charge of their lives and livelihoods, to campaigning for change that lasts. That's Oxfam in action.

WHAT WE DO?

To have the biggest possible impact on the lives of poor people worldwide, Oxfam concentrates on three interlinked areas of work.

1. Emergency response

People need help in an emergency—fast. We save lives, swiftly delivering aid, support, and protection; and we help communities develop the capacity to cope with future crises.

2. Development work

Poor people can take control, solve their own problems, and rely on themselves—with the right support. We fund long-term work to fight poverty in thousands of communities worldwide.

3. Campaigning for change

Poverty isn't just about lack of resources. In a wealthy world it's about bad decisions made by powerful people. Oxfam campaigns hard, putting pressure on leaders for real lasting change.

WHY WE DO IT, WHY FIGHT POVERTY?

The answer is basic too. Belief! Belief that in a wealthy world poverty is unjustifiable, and can be prevented. Belief that injustice must be challenged. And, belief that with the right help, poor people themselves can change their lives for the better, for good.

OXFAM INDIA

Oxfam India strives to secure the right to a life with dignity for all by actively engaging people and policy-makers in the inclusive development of society.

We are working to ensure that everyone has access to education, health, and social protection; people are able to overcome poverty by earning a decent livelihood with fair trade opportunities; women lead a life of dignity, free from violence; and communities are prepared to deal with the impact of climate change, natural, and man-made disasters.

Oxfam India is a newly restructured Indian non-governmental organization integrating the 60-year-old India operations of 6 separate international Oxfam affiliates

working in the country. A rights-based organization, Oxfam fights poverty, gender justice, economic justice, and other humanitarian issues. Oxfam also vigorously pursues linking grassroots programmes with policy advocacy. The new organization is a national entity with presence in 6 cities and a staff of 120 people working towards implementing new and existing programmes through more than 200 partners and allies, and building a strong national international advocacy capacity.

DLF LTD

DLF Ltd is India's largest real estate company in terms of revenues, earnings, market capitalization, and developable area. It has over 60 years of track record of sustained growth, customer satisfaction, and innovation. The company has 399 msf of planned projects with 56 msf of projects under construction.

DLF's primary business is development of residential, commercial, and retail properties. The company has a unique business model with earnings arising from development and rentals. Its exposure across businesses, segments, and geographies, mitigates any down-cycles in the market. DLF has also forayed into infrastructure, SEZ, and hotel businesses.

The DLF group was founded in 1946. DLF developed some of the first residential colonies in Delhi, such as Krishna Nagar in East Delhi, which was completed in 1949. Since then, DLF has been responsible for development of many of Delhi's other well-known urban colonies, including South Extension, Greater Kailash Colony, and Hauz Khas.

Following the passage of the Delhi Development Act in 1957, the state assumed control of real estate development activities in Delhi, which resulted in restrictions on private real estate colony development. We, therefore, commenced acquiring land at relatively low cost outside the area controlled by the Delhi Development Authority, particularly in the district of Gurgaon in the adjacent state of Haryana.

This led to our first landmark real estate development project—DLF Qutab Enclave—which has now evolved into DLF City. DLF City is spread over 3,000 acres in Gurgaon and is an integrated township, which includes residential, commercial, and retail properties in a modern city infrastructure with schools, hospitals, hotels, and shopping malls. It also boasts of the prestigious DLF Golf and Country Club with night golfing facilities.

DLF VISION

To contribute significantly to building the new India and become the world's most valuable real estate company.

DLF MISSION

To build world-class real-estate concepts across six business lines with the highest standards of professionalism, ethics, quality, and customer service

DLF VALUES

- Sustained efforts to enhance customer value and quality
- Ethical and professional service
- Compliance and respect for all community, environmental, and legal requirements

JAYPEE GROUP

The Jaypee Group is a 10,000 crore, well diversified, infrastructural industrial conglomerate in India. Over the decades, it has maintained its salience with leadership in its chosen line of businesses.

- Engineering and construction
- Cement
- Power
- Hospitality
- Real Estate
- Expressways and highways

Environment Policy

“An Impetus for the Industry, a Conscience for Society.” Jaypee group believes that harmony between man and his environment is the prime essence of healthy life and living. The sustenance of our ecological balance is, therefore, of paramount importance. The Group recognizes its joint responsibility with the Government and the Citizens to protect and preserve the environment.

The Group is, thus, committed to making its operations environmentally acceptable, on a scientifically established basis, while fulfilling customers’ requirements for excellent quality, performance, and safety. As such, the group has evolved an Environmental Policy the aim of which is to do all that is reasonably practicable to prevent or minimize, the risk of adverse environmental impact arising from our business operations while working with, in and around Nature.

The Environmental Policy reflects the continuing commitment of the management and employees for sound Environmental Management of its operations. The Policy applies to bidding, sub-contracting, designing, planning, execution, testing, delivering service or a product to the customer and handling complaints, if any. The Policy is, thus, applicable to all the companies, subsidiaries, associates, and affiliate companies of the Group.

ADELPHI

adelphi is a leading think tank for policy analysis and strategy consulting. We offer creative solutions and services on global environment and development challenges for policy, business, and civil society communities. Our projects contribute to sustaining natural life systems and fostering sustainable enterprises. adelphi’s clients include international organizations, governments, public institutions, corporations, and associations.

We bring together scientific and technical expertise with analytical and strategic competence, practical application, and constructive problem solving. Our integrated approach combines research, consulting, and dialogue on six main topic areas. International and interdisciplinary project teams contribute worldwide to a common future—working in different cultures and languages. In the last ten years, adelphi has realized more than 400 projects for 100 clients, offering professional and strategic support to crucial environment and development policies and processes. Sustainability is the foundation and leitmotif of our internal and external conduct. All our activities are climate-neutral and we apply a certified environmental management system.

ASIAN DEVELOPMENT BANK

ADB is an international development finance institution whose mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Headquartered in Manila, and established in 1966, ADB is owned and financed by its 67 members, of which 48 are from the region and 19 are from other parts of the globe. ADB’s main partners are governments, the private sector, non-government organizations, development agencies, community-based organizations, and foundations. Under Strategy 2020, a long-term strategic framework adopted in 2008, ADB will follow three complementary strategic agendas: inclusive growth, environmentally sustainable growth, and regional integration. In pursuing its vision, ADB’s main instruments comprise loans, technical assistance, grants, advice, and knowledge. Although most lending is in the public sector—and to governments—ADB also provides direct assistance to private enterprises of developing countries through equity investments, guarantees, and loans. In addition, its triple-A credit rating helps mobilize funds for development.

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