Incentives and Disincentives for Groundwater Conservation- How to Bell the Cat?

Webinar –Jointly organised by the Indian Society for Ecological Economics (INSEE) and Partners in Prosperity (PnP)
September 12th, 2020; 4:00 – 6:00 pm IST

Webinar Proceedings

Dr. Samraj Sahay

1. Background

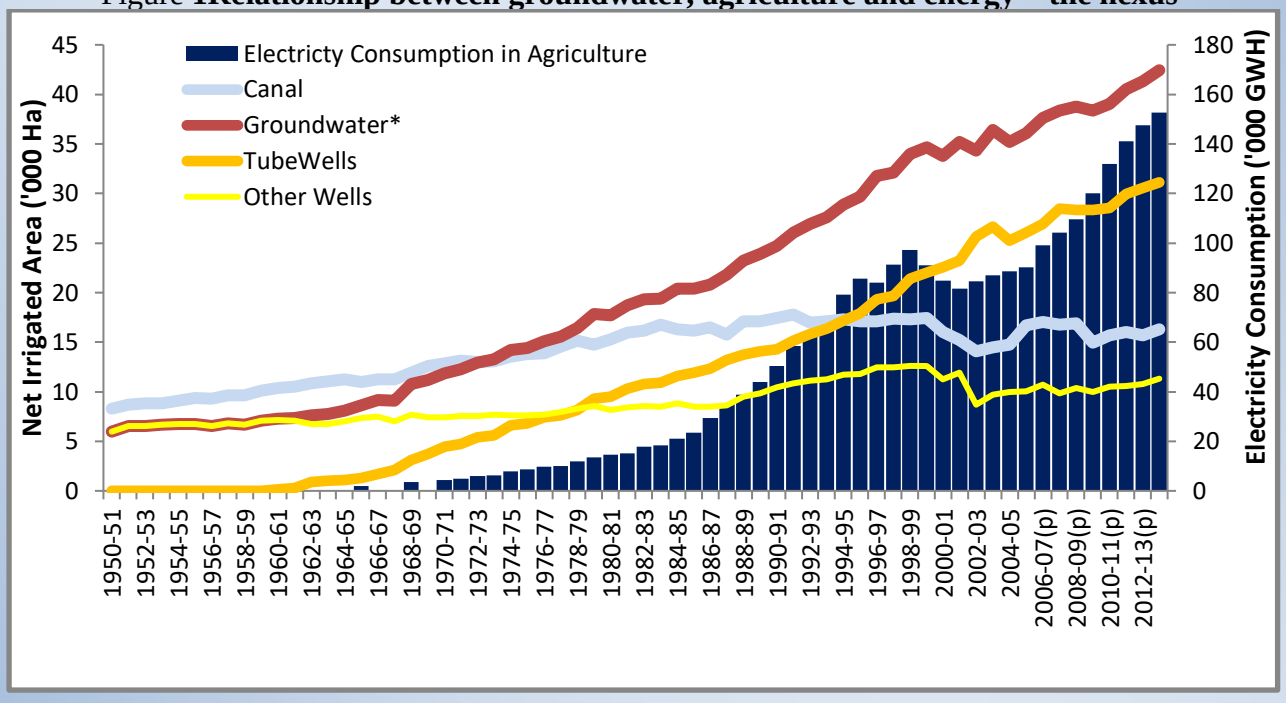
In the last five decades, the number of farmers dependent on groundwater irrigation has risen sharply, and inadequate regulation on water use, lopsided price incentives, and energy subsidies to farmers have proliferated exploitation of groundwater through borewells. Wastage of water in agricultural activities is the main source of water use inefficiency in India. The farms consume more water to grow the same volume of crops compared to the global averages. Despite being a water-scarce country, agricultural exports include water-intensive crops such as Basmati rice, cotton, sugar, etc. Around 60 percent of agriculture depends on groundwater, while 80 percent of rural people use it for their domestic needs. The dire state of water governance in the country is result of both state and market failure. Unless incentives are put in place for efficient use of water, farmers will continue to over-exploit groundwater to grow paddy (with guaranteed procurement by the FCI) because s/he is not apaying for the environmental and social externalities with the society bearing the costs. The failure of the state is in instituting the wrong incentives and also in the mismanagement of water systems. Unless over exploitation of water is quickly controlled, the country is likely to witness rising water-related crises and conflicts in the years to come. The phenomenon of free or subsidised electricity has negatively affected the quality of electricity supply to rural consumers, the financial health of DISCOMs, and the State Governments. Unsurprisingly, power sector reforms have called for reduction of subsidies to agriculture. However, such reforms have been largely ineffective. There is also strong resistance from the farmers on hikes in electricity tariffs. Attempts to incentivise farmers away from paddy to less water-intensive crops like maize had limited success. The linkages between agriculture, groundwater extraction, and electricity pricing deserve a more nuanced understanding. A more holistic perspective and joint efforts by all stakeholders can address the challenges in electricity-based groundwater irrigation.

Given the urgency to address this vital and widely acknowledged challenge the webinar brought together top experts from the related fields - agronomists, water specialists, ecological economists, policy makers and others on a single platform. As intended, the webinar greatly enriched the understanding on policy-relevant issues on water conservation and sustainable use focusing agriculture. It answered some of the most pertinent questions related to sustainable water management for water intensive crops. This post webinar report brings together the problems identified; major challenges; opportunities/cases with remedies; solution to the challenges and recommendations made.

Factsheet: 'Groundwater–Agriculture-Energy' relationship

- India has 18% of world population, having 4% of world's fresh water, out of which 80% is used in agriculture.
- Share of groundwater in net irrigated area increased from 28.67% in 1950-51 to 62.33% in 2013-14.
- India is the largest user of groundwater in the world with 37% global consumptive use of groundwater in agriculture.
- Groundwater irrigation produces 49% of rice and 72% of wheat in the country.
- Production of rice and wheat increased from 53% of the total food grains in 1950-51 to 76.17% in 2017-18.
- There are 20 million operational groundwater wells (tube wells and dug wells) in India at present - 98.7% continue to remain under private ownership
- Nearly 85% of the groundwater pumping energy is provided by electricity.
- Number of mechanised irrigation pump increased from 5000 in 1951to 19 million in 2000 and stands at 22-25 million at present.

Figure **1Relationship between groundwater, agriculture and energy – the nexus**



Source: DES, MoA, 2016; Energy Statistics (various years), MoSPI, GoI; Growth of Electricity Sector in India from 1947-2017, CEA 2017. Note: *Groundwater includes both tube wells and other wells

- Agriculture consumes 18% of the total electricity consumption by all sectors in India and nearly all this is used for pumping groundwater.
- Electricity consumption in agriculture increased 235 times while total electricity use increased just 77 times during the period 1960-2016.
- Currently, 14% blocks (groundwater observation units) in India are overexploited, i.e. annual groundwater extraction exceeds natural recharge.
- The overexploited blocks are mainly concentrated in two north-western states of Punjab and Haryana - groundwater use exceeds natural recharge by 49% and 35%, respectively.

Source –GOI, Report of Fifth Census of Minor Irrigation Schemes (2017); Prayas (Energy Group). (2018); Shah et al. (2018); Sidhu et al. (2020); CGWB (2017); Agricultural Statistics at a Glance 2019, DES, MoA (2019).

2. Profile of the Panellists

Moderator

Dr Srinivas Chokkakula is **the MoJS (Ministry of Jal Shakti) Research Chair - Water Conflicts and Governance at CPR**, where he leads the Transboundary Rivers, Ecologies, and Development studies (TREADs) programme. Srinivas has an interdisciplinary training in geography, planning and engineering. He has a PhD from the University of Washington, Seattle, and an MA from the University of Miami, Florida in political geography; an earlier Masters in Urban Environmental Planning from CEPT University, Ahmedabad; and a B. Tech. in Civil Engineering from Kakatiya University, Warangal. His research and policy interests lie primarily in the water sector, focusing on transboundary water conflict/cooperation and governance. He has written and published widely on the topic, both in academic journals and mainstream outlets. His interests extend to the broader area of politics of infrastructure development, including inland waterways, smart cities, and rural roads. As the MoJS Research Chair, he is engaged closely with relevant government agencies and is often consulted on various water policy and institutional issues. Srinivas is currently a Member of the Drafting Committee of India's National Water Policy.

Speakers

Mr. Mohinder Gulati is the **former Chief Operating Officer of the Sustainable Energy for All Initiative and former Advisor (Energy), World Bank**., He played an important role in building international consensus on Sustainable Development Goal 7 on energy, and engagement of energy sector stakeholders in Paris Climate Agreement. He is a graduate in Management (Harvard and Delhi University), Physics (Delhi University), and Associate of Indian Institute of Bankers. Mohinder Gulati worked with the World Bank for more than twenty years. As Sector Leader (Sustainable Development) for South East Europe, he managed policy dialogue, project development and implementation, and partnership with key development partners and external relations. He led a multi-stakeholder dialogue on a thermal power project in Kosovo, environmental upgradation of highly polluting thermal power projects in Bosnia-Herzegovina, development of sector strategies in post-conflict environment in Western Balkans and establishing innovative approaches in energy efficiency investment in public buildings in Serbia. As Program Leader in East Asia and Pacific region of the World Bank, Mohinder led the dialogue on establishing a regional electricity market in Greater Mekong Sub-region to integrate Southern China, Thailand, Vietnam, Laos and Cambodia, managed a large cross-border export-driven private sector hydropower project (Nam Theun 2) in Laos, rural energy access programs, and initiated a cookstove program in Cambodia. In South Asia he led World Bank-funded power sector restructuring and reform program in several Indian states (Andhra Pradesh, Uttar Pradesh, Orissa), enactment of new laws and regulation, creation of new regulatory institutions, and construction of power generation, transmission, and distribution projects, and supervised several projects in power generation, transmission, and distribution in many Indian states. He has published two reports on energy-water-agriculture nexus titled "Direct Delivery of Power Subsidy to Agriculture in India" and "Grow Solar, Save Water, Double Farmer Income: An Innovative Approach to Energy-Groundwater-Agriculture nexus in Rajasthan".

Dr. Aditi Mukherji is a human geographer and has a PhD from Cambridge University, United Kingdom. She is a **Principal Researcher and a Research Group Leader at International Water Management Institute. Previously**, she led the Water and Air Theme at the International Centre for Integrated Mountain Development (ICIMOD) in Nepal. She is the coordinating lead author of the water chapter of the 6th Assessment Report (AR6) team of the Intergovernmental Panel on Climate Change (IPCC) and is a core writing team member of the AR6 Synthesis Report. She is an associate editor of Climate and Development Journal, and Section Editor of Water Security Journal. She has over 20 years of experience working on policies and institutions of water resources management with a special focus on water-energy-food nexus and has published over 50 peer reviewed papers. She has worked in South Asia, including the Hindu Kush Himalayan countries and in Central Asia and Nile Basin. She is the first ever recipient of the Borlaug Field Award (2012) given by the World Food Prize Foundation, USA, which recognises "exceptional, science-based achievement in international agriculture and food production by an individual under the age of 40 who has clearly emulated the same intellectual courage, stamina and determination in the fight to eliminate global hunger and poverty as was demonstrated by Dr. Norman Borlaug as a young scientist."

Dr. Nilanjan Ghosh is **the Director at Observer Research Foundation (ORF) Kolkata**. He is a natural resource economist and econometrician by training and obtained his PhD from the Indian Institute of Management (IIM) Calcutta, and certification in Water Diplomacy from the Harvard University-MIT-Tufts University-housed programme on the subject. His research interests also include international trade and financial markets, viewed through the lens of the developmental discourse. Dr Ghosh advised WWF India for setting up their Ecological Economics practice. He has conducted a large number of consultancy/advisory assignments for organisations like IUCN, FORMAS-The Swedish Research Council, UNCTAD-India, Chinese Consulate in Kolkata, WWF-UK, IWMI-WLE, World Bank, and many others. He had been a Visiting Fellow at the Linnaeus University, Sweden, in 2008 and 2015, and has visited Uppsala University (Sweden), Massachusetts Institute of Technology (USA), and Stanford University (USA), at various points in time. One of the leading ecological economists and development analysts of south Asia, he is considered a pioneer in the application of neoclassical and heterodox economics in water governance.

Ms. Mridula Ramesh is **the author of critically acclaimed, 'The Climate Solution – India's Climate Change Crisis and What We Can Do About It'. She is founder of the Sundaram Climate Institute**, which focuses on waste and water solutions and education. She is an active angel investor in cleantech start-ups, with a portfolio of over a fifteen start-ups. Mridula sits on several angel management groups, including the Indian Angels and the Chennai Angels, and is involved in several initiatives to spur entrepreneurship to build climate resilience. A graduate with distinction of Cornell University (with majors in Chemistry and Microbiology), with an MBA from the Kellogg School of Management, Mridula worked at McKinsey in Silicon Valley before returning to India. She writes regularly on climate change, with her columns appearing in Firstpost and earlier in the Hindu, Live Mint, Bloomberg Quint and Conde Nast. She is the Executive Director of Sundaram Textiles and lives and experiments in Madurai in a net zero-waste house with her husband and two children. She is part of the Advisory Committee, UNDP

India National Circular Economy Project, and the Chairperson of the Board of Governors, of NIT, Andhra Pradesh.

Dr. R. Parthasarathy is the **MEGA Chair Professor and Director, Gujarat Institute of Development Research, Ahmedabad**. He has a PhD in Economics from the Institute for Social and Economic Change, Bangalore. He was earlier a Professor at the Faculty of Planning, CEPT University, Ahmedabad where he taught Natural Resources Management and Environmental Economics to Postgraduate and Graduate students, besides guiding Masters and PhD dissertations. His research interests are natural resource management, environmental economics and urban planning. He has undertaken many studies relating to large scale irrigation, river basins, water management, fisheries, mangroves, and the coastal cities. He has been focusing on the social distributions of power, leadership, economic development and the impacts of policy and development organizations in these sectors with special focus on the interventions by governments and NGOs both at policy and at the level of implementation. Currently he is leading MEGA Centre at GIDR that is working closely with the Gujarat Metro Rail Corporation in the setting up of Metro Rail in Ahmedabad. He has coordinated a network of researchers and organizations involved in the process research on participatory irrigation management programs in India and Nepal for over five years. He was also actively involved in the Urban Knowledge Network Asia (UKNA). His collaborative work includes both Indian and overseas universities and institutions like IWMI and NGOs. Besides serving as a consultant to ADB, DFID, London and the Centre for Development Studies, University of Wales, U.K, he has also served as a member in a number of Governmental committees. As a Shastri Faculty Research Fellow, he has collaborated with the Department of Political Science, University of British Columbia, Vancouver, Canada. He has also been a Visiting Scholar at the Department of Environmental Science, Policy and Management, University of California, Berkeley with a World Bank aided Post-doctoral research fellowship in Environmental Economics. He has co-authored and co-edited books and has published extensively.

3. Highlights of the Panel Discussion

The session started with a brief description on the motivation behind organizing the webinar, about the organizers, the general housekeeping during the webinar and introduction of the moderator for this webinar by Dr. Manab Chakraborty, the CEO of Partners-in-Prosperity. This was followed by handing over the floor to the moderator of the webinar Dr. Sriniwas Chokakula, MoJS (Ministry of Jal Shakti) Research Chair - Water Conflicts and Governance at CPR. Before introducing the speakers, Dr. Chokakula set the context of the webinar by bringing to the fore the issue of groundwater challenges and why it is so important to discuss it. He emphasised on the problem of groundwater depletion and the need for conservation based on the fact that the number of overexploited zone as monitored by Central Ground Water Board (CGWB) is continuously increasing. The existence of energy-water-food nexus with free electricity and subsidies is detrimental in states like Punjab. He then introduced the attendees to the format of the webinar where the speakers would follow the order decided for the webinar which starts with setting up of the problem, dealing with some complex and deeper issues and solutions, general groundwater management issues in urban and peri-urban areas and finally engagement with possible solution. Dr. Chokakula then introduced and invited the first speaker of the session Mr. Mohinder Gulati.

Mr. Mohinder Gulati: Former Chief Operating Officer of the Sustainable Energy for All Initiative and former Advisor (Energy), World Bank

Mr. Gulati started off by highlighting the deepening crisis of groundwater depletion in India and stressed on the need for identifying the problem within the context of 'water, energy and agriculture' nexus. His main emphasis was on correct identification and definition of the problem to avoid putting the wrong bell on the neck of a wrong cat or in other words we need to know the problem and what we are trying to solve. Unless we do so we cannot look for policy interventions as solution. He highlighted the fact that the policies which were very progressive during the green revolution later on due to poor governance turned out to be a perverse nexus by 1990 and resulted in ground water exploitation. In view of this he identified four major problems – the rural-urban inequality which is expected to increase further with time, low agricultural household income, power sector loses which contributes more than half of the state fiscal deficit and comes at the cost of reduction in social sector expenditure having adverse effect on human development, and nearly half of losses for power sector and agricultural sale is attributable to groundwater depletion which further established the role of nexus. Four realities were flagged by him as major hindrances in finding solutions. This included reluctance of farmers to give up subsidies, unwillingness of decision maker to increase agriculture tariffs, crucial role of irrigation in rural prosperity and slow market liberalization and agricultural diversification. Talking about the bell or the policy instruments that can be adopted as solution must meet certain criteria which includes no change in policy for free or subsidized power --one of the major binding constraints; meeting the requirement of agriculture; incentives for efficient use of power and water; reduction of fiscal burden on government and power distribution companies; and reduction of dependency on agriculture of rural economies.

Having talked about problems, he mentioned about the two initiatives. One is the learning by doing experiments carried out in groundwater scarce state of Punjab that can serve as solution to the problem. Punjab launched a '*Pani Bachao Paise Kamao*' (PBPK) scheme under which the farmers were allocated electricity, which is free in Punjab, based on the pump capacity and were paid an Rs 4/kWh for any savings. The results showed a reasonable water savings with no or marginal reduction in the yield. The second initiative is a study carried out in Rajasthan titled '*Grow Solar, Save Water, Double Farmer Income*' that showed that it is possible to achieve the trifecta described in the title of the report if farmers replaces grid connected electric tube wells with grid connected solar pumps. This would be a win-win situation for farmers with doubling of their income, earning for DISCOMs and 30% return on investment as subsidy for the governments. He further highlighted the findings related to potential trade-off between water and electricity where farmers find it beneficial and prefer to sell electricity rather than to extract extra water. He concluded by mentioning about '*Drought Premium*', a policy tool where farmers are paid Re 1 extra for each unit of power that they sell during drought period. This conserves water and being a commercial transaction and not charity upholds the dignity of the farmers during periods of distress.

Dr. Aditi Mukherji: Principal Researcher and a Research Group Leader at International Water Management Institute.

Dr. Aditi Mukherji shifted the focus to a more complex issues of groundwater that exists in the eastern part of India, the state of West Bengal where the crisis is not about the availability of groundwater but the major crisis is of policies and institutions related to groundwater. She walked through her research project that was carried out in West Bengal to understand the impact of electricity policy changes (electrification of agricultural well) at the start of present decade on agriculture and groundwater conservation. Following a brief introduction to a well documented agriculture history of the state marked with synonymous growth trajectory of water intensive *boro* paddy, she highlighted the groundwater and electricity policy reforms that took place between 2007-2012 such as universal metering, non-requirement of prior permits for electricity connections and one-time assistance by government for electrification of pump set. These measures reduced the transaction and fixed cost of electrification which resulted in sharp increase in electrification of pumps from 2011-2019. Based on the field data and the empirical analysis, the study finds that the intended impact of policy changes in terms of encouraging *boro* farming, increasing cropping intensity and increasing farmers income were restricted to only two districts of West Bengal - Cooch Behar and Pashcim Medinipur, where there was the maximum increase in new electric connections.

No visible impact of the policy changes on agriculture and groundwater was observed in rest of the districts. This led to several hypotheses. One of the hypotheses is that it did not result in increase in pumping capacity. The qualitative analysis finds that most of the new electric connections were either the temporary connections got converted into permanent or those using diesel pumps shifted to electric pump. This resulted in the stock of irrigation capacity remaining unchanged. Another hypothesis was that the reduction in transaction cost enabled water buyers to becom the electric pump owners, hence no drastic change in irrigation potential, cropping patterns or agricultural practices. The changes in the structure of groundwater market due to metering which has possibly dampened the informal water market was put forward as another hypothesis in this regard. Finally the study hypothesised that the most important reason was squeezing of the profit margins due to continuous increase in electricity tariffs which doubled in the last ten years. This increased the input cost for the farmers who already pay more than commercial consumers and are often paid less than the MSP for the paddy.

In addition to these farmers also have to face the impacts of issues such as COVID-19 and super cyclones like Amphan; climate events that have not occurred in the last fifty years. Dr Mukherji concluded by putting forward tentative policy recommendations such as revision of agricultural electricity tariff policy such as relief for small farmers, reduction in time of the day tariff and introduction of mixed tariff (flat cum metered) to encourage informal water market; reform of paddy procurement system to encourage *boro* cultivation; essential for income, food security and absorption of surplus labour and finally on a larger scale alignment of India's cropping system to its overall water endowment like shifting cultivation of water intensive crops from water scarce to water abundant states.

Dr. Nilanjan Ghosh: **Director at Observer Research Foundation (ORF) Kolkata**

Dr. Nilanjan Ghosh began by emphasising that the major problem lies with fragmented governance where both groundwater and surface water are treated as separate entity. The existing paradigm in India is "*essentially reductionist"* as we fail to acknowledge that groundwater and surface water are not separate and forms the part of broader water scheme. This is evident in India as we have separate agencies dealing with surface water and sub-surface water and reason why we need an integrated approach in line with the global call for integrated governance. The integrated governance at any scale acknowledges a symbiotic relationship between groundwater and surface water as the two keep interacting with each other. In the given context he stressed on the fact that nearly fifty percent of the springs in Himalayan region is going to dry having serious repercussions on the flow of two major river systems of India - Ganges and Brahmaputra. The other challenge comes in the form of inefficient initial water laws where the land owners by default assumed the ownership of the aquifer within the boundary of his land ignoring the fact that aquifers are not confined by geographical limits. This problem of large number of users and subsequent multiple interference complicated the groundwater regulations, financial investment and implementation of government bills.

As for the problem of extensive groundwater extraction and water conflict, he stressed on the point that these are the results of "*wrong delineation of food security*". The green revolution, followed by introduction of MSP and procurement by the government through FCI resulted in looking at food security in terms of paddy and wheat only. Over the years MSPs for these two has increased at a much faster rate as compared to less water consuming millets. This has resulted in displacement of millets with water intensive paddy. For example in the Cauvery basin in Karnataka acreage of ragi has been decreasing whereas acreage of paddy which consumes ten times more water has been increasing resulting in groundwater depletion which in turns affects the flow of the surface water due their interdependency. The MSPs are largely responsible for the farmer's decision. Further the problem also arises as the larger ecosystem dimension is missing in the definition of food security. The linkage between the ecosystem and food security is hardly acknowledged in the government policies which are completely ignorant about the need for ecosystem services of water for the downstream communities. In this regard an experiment was conducted to look at the value of ecosystem services for the downstream community from two types of interventions – water efficiency and yield enhancement and crop diversification in upstream under different scenarios. Findings suggested that trade-off does not exists rather there is reconciliation, there will be increase in the values of the ecosystem services along with increase in water savings and values gains for farmers.

Dr Ghosh concluded by emphasizing five major points which included integration of groundwater governance with surface water, a call for holism as against reductionism; relation between water and food security is not always linearly related and the ecosystem dimension needs to be integrated in definition of food security to ensure sustainable flow of provisioning services; better water management practises can reduce water use, increase values of provisioning services for downstream community and could contribute to increase in farm income and pricing of water representing scarcity value should be followed. Finally he reiterated the call for creation of a transdisciplinary national water commission by merging of the Central Water Commission and Central Ground Water Board which would incorporate

complimentary subject area like hydrometeorology, river ecology, ecological economics, agroeconomy , participatory resource planning and management and each headed by subject experts with basin as unit of governance.

Ms. Mridula Ramesh: Author of critically acclaimed, 'The Climate Solution – India's Climate Change Crisis and What We Can Do About It' and founder of the Sundaram Climate Institute.

Ms. Mridula Ramesh took the discussion to somewhat different yet extremely important issues of water management in the urban and peri-urban areas. She started with the argument that just by "*managing incentives for withdrawal is more like judging the health of a bank account through withdrawals only whereas the deficit or the recharge of groundwater is also equally important*". The benefits from tanks are nuanced; for instance, non-cash benefits are in some cases more important than cash, for many. Water tanks are sites for community festivals, and local tourism. While tank water can be a perfect primary water source for many uses and situations, it is also a great backup water supply for emergency situations. She went on to talk about the project on saving tanks to recharge groundwater in Madurai city with the focus on status of groundwater in Madurai, the linkage between surface and groundwater and the incentives of saving surface water and groundwater. Madurai receives its water supply from different sources which are mostly seasonal; hence it cannot meet the summer demand. Nearly sixty percent of the households rely on groundwater and around forty percent of them buy water with those having access to groundwater spending less on buying water. The study finds that tanks or surface water had tremendous impact on the groundwater. Tanks have been disappearing in most of the urban areas across India. Another major finding is the difference in groundwater recharge potential with functional tank being far more efficient than non-functional tanks. The major question that needs to be answered is what are the incentives to keep tanks functional that would ensure availability of groundwater? The evidence from rural areas outside Madurai shows that tanks are centre of life in rural India. Those with their land close to tanks ~~and who shoulders the responsibility of maintaining the tank~~ gets the maximum benefits. The benefits include more cropping cycle due to easy accessibility of water and most importantly cash flow from fishery and maintenance of livestock. Once the urban constructions start in these areas the debris, waste and sewage chokes the feeder of these tanks and soon they turn non-functional. These tanks go dry and attract land scarce cities to fill it up.

The best solution for preserving these tanks is to have the communities adjacent to these tanks with the responsibility of preserving the tank. The communities need to be vested in the health of the tank - i.e., receive tangible benefits from the healthy functioning of the tank.The other solutions include spreading awareness and educating people about the role of tanks in recharging groundwater which could reduce their monthly spending on buying water. Tanks can be source of cash flow through tank tourism. Findings of a study done in Kodiakanal revealed that the tank tourism generated job opportunities with more than 700 jobs in the periphery of the lakes itself. Ms Ramesh concluded by emphasizing the linkage of surface and groundwater, need to keep tanks alive and functional to ensure groundwater recharge,

improving link between community and tanks crucial for securing tanks which can be achieved by educating people about the issue and improving cash flow through tank tourism.

Dr. R. Parthasarathy: MEGA Chair Professor and Director, Gujarat Institute of Development Research, Ahmedabad

Dr. R. Parthasarathy began by emphasising the need to look at groundwater and surface water in a complementary fashion. He invited the audience to have a look at how the garlanding of river mouths and the water diversion works have resulted in decentralizing the large irrigation schemes. In many ways these are novel approaches of water management at a decentralized level. As for the diversion works of surface water, the best example is the diversion of Narmada canal waters on to the Sabarmati river in Ahmedabad which has been a game changer in many ways. As a result of this diversion, not only the groundwater levels in Ahmedabad have gone up but the multitude of tube wells are now redundant due to the availability of surface water. The other example is of the Sujalam Suphlam Yojna where the diversion of the surplus flood water from Kadana reservoir and Narmada to the northern districts of Gujrat fills up the tanks and check-dams which in turn recharge the groundwater in these otherwise water scarce districts marked by overexploitation due to a very well developed water market. A similar diversion project named Saurashtra Narmada Avtaran Irrigation (SAUNI) is currently underway which carries the excess Narmada water to the Saurashtra region where it fills many dams besides recharging tanks and lakes. The programme that aims at large scale desilting of tanks complements these recharging efforts to ensure effective utilization of the diverted water. In addition to this Saurashtra since the late 1980s and in the 1990s have developed a large number of watersheds. These programmes taken up by Government and Non-Government agencies involved construction of a large number of water harvesting structures such as check dams and tanks that have contributed to the agricultural growth story of Gujarat. The participatory groundwater management now involving participation of 'Barefoot Experts' known as *Bhujal Jankars* in knowledge building on aquifers have found to be very useful in groundwater management in these arid and semi-arid regions. He reiterated the crucial role of people and local bodies in maintaining the good health of these water harvesting structures that complement the larger surface water irrigation infrastructures. He emphasised that it is time again to have the watershed programmes re-introduced perhaps with the help of MGNREGA.

Moving on to urban rainwater harvesting, Chennai is a good example which had passed a water harvesting legislation in 2003 making rooftop rainwater harvesting mandatory. In addition to this, Chennai case also showed that cleaning and restoring of urban water bodies is far more important as such actions led to considerable increase in groundwater levels in some areas of the city. As in Gujarat, Chennai case too emphasises the need to have the tanks and smaller water harvesting structures in good repair. As for water energy nexus, since it is difficult to price water, surrogate two-part tariff pricing based on energy used to withdraw water (flat and metered tariff) based on engine horsepower and actual use of electricity has worked well in Gujrat. Dr. Parthasarathy concluded by highlighting the accountability and governance of the different options for decentralised surface water and groundwater management.

Concluding remarks

While presenting his concluding remarks on the session, the moderator Dr. Chokakula invited Prof. Tushar Shah, Senior Fellow at International Water Management Institute and former director of the Institute of Rural Management at Anand, Gujrat who was present among the attendee to share his expert views on the topic. Prof. Shah accepted the invitation and started by bringing in the aspect of human behaviour which is very crucial for groundwater management. He stressed on the fact that since independence the thrust in water management has been on supply side with investments in irrigation infrastructure. Given the enormous number of users in India there is a need for creating a complex irrigation economy. The number of users or the individual decision makers is huge in India which poses a great challenge on producing behavioural change. The bigger question is how we encourage millions of farmers to use a depleting resource which is only partially renewable in a manner that they can maximize the productivity, equity and environmental sustainability. The behavioural changes can be achieved by having dialogues with farmers on the importance of responsible use of groundwater, use of water saving technologies, recharging groundwater or shifting to alternative cropping etc..The regulatory approaches in producing behavioural change have worked in other countries but it simply did not work in India. The other approach that worked very well in this regard is the mass movements for groundwater management under guidance of spiritual leaders. As for the incentives such as free power, it works antagonistically to the whole idea of producing behavioural change to conserve groundwater.

The session ended with a vote of thanks by Ms Anuva Choudhary from PnP.

4. Q&A

A very rich and interactive Q&A round continued throughout the webinar through the Q&A box. The most pertinent question put forward to the panellist was of suggesting a way out given the fact that most of the policy interventions have failed and still there are no policies specific to reducing dependency on groundwater or promotion of alternatives and groundwater recharge. The key strategies suggested by the panellist included creating awareness about groundwater crisis by providing regular information on groundwater levels to the community, realigning farmer incentives, equip farmers with the technology to respond to the crisis, provide incentives to modify their behavior and change in food policy like realigning MSPs that would disincentivize farmers from growing water intensive crops. Further to reduce dependency on groundwater, policy interventions have to be locally contextualized and include a bundle of interventions like rainwater harvesting and dynamic interaction between surface and groundwater. There should be more schemes on farm water harvesting which includes restoration of village ponds to increase water retention and recharge capacity in line with a similar scheme in West Bengal funded by MGNREGA.

The issue of reducing food wastage having enormous impact on saving groundwater was also highlighted. In addition to food policies, the food choice of the consumer plays a significant role in farmer’s decision to go for water-intensive crops. The consumer choice coupled with lower price of rice in the PDS was instrumental in replacing ragi with water intensive rice in

Karnataka. On the issue of including the environmental price to extraction energy price, the consensus that emerged was that the urban consumers would have to pay more as it will be reflected in food prices even if we go for scarcity value pricing that reflects the environmental costs.

5. Outcomes and Ways forward

Some of the suggestions as a way forward -

- Accurate identification and defining of the problem is essential for finding the solutions to groundwater problem in India.
- Positive outcome of experiments such as paying farmers for saving electricity or replacing grid connected electric tube wells with grid connected solar pumps needs to validated in other parts of the country for scaling up such interventions.
- Fine tuning of the agricultural electricity tariff policy such as mixed tariff (flat cum metered) which would provide relief to small farmers by encouraging informal water markets.
- Alignment of India's cropping system to its overall water endowment.
- Doing away with reductionist paradigm and acknowledging integrated governance for surface and groundwater by creation of a transdisciplinary national water commission with basin as unit of governance.
- Integration of ecosystem dimension in food security to ensure sustainable flow of provisioning services for the downstream community
- Restoration and maintenance of tanks to keep it functional is essential for groundwater recharge and the associated benefits of tanks like tanks tourism.
- Decentralized surface water or diversion of surface water from water surplus to water deficit area can be a game changer for groundwater recharge and surface water management.
- Producing changes in human behaviour is the most crucial aspect in groundwater management.
- The behavioural changes can be achieved by having dialogues with farmers on the benefits of groundwater conservation and to a great extent by raising the awareness levels through mass movements for groundwater management.

ANNEXURE

Webinar Gallery

***Dr. Aditi Mukherji*:** Principal Researcher and a Research Group Leader at International Water Management Institute.

Dr. R. Parthasarathy: MEGA Chair Professor and Director, Gujarat Institute of Development Research, Ahmedabad

***Mr. Mohinder Gulati*:** Former Chief Operating Officer of the Sustainable Energy for All Initiative and former Advisor (Energy), World Bank

Dr. Nilanjan Ghosh: Director at Observer Research Foundation (ORF) Kolkata

Dr. Sriniwas Chokakula: MoJS (Ministry of Jal Shakti) Research Chair - Water Conflicts and Governance at CPR

***Ms. Mridula Ramesh*:** Author of critically acclaimed, 'The Climate Solution – India's Climate Change Crisis and What We Can Do About It' and founder of the Sundaram Climate Institute.

Summary report of the attendee

Total registration – 440

Total attendees– 352

Duration – 126 minutes