



**Regional workshop
'Energy and Resource Efficiency in Urban Water Management'**

December 20, 2013

Venue: Casuarina Hall, India Habitat Centre (IHC), New Delhi.

Organised by CSE, New Delhi

Supported by:

Comprehensive Capacity Building Programme (CCBP) National Urban Renewal Mission (NURM), Ministry of Urban Development, Govt of India, Delhi Jal Board and Urban Development Department, Govt. of NCT of Delhi

Acknowledgements

Centre for Science and Environment (CSE), New Delhi in support with Delhi Jal Board and Urban Development Department, Government of NCT of New Delhi organized a regional workshop on 'Energy and Resource Efficiency in Urban Water Management' on December 20, 2013 in New Delhi at Casuarina Hall, India Habitat Centre (IHC), New Delhi. The organizers acknowledge the distinguished guests Mr. R.K. Srivastava, Secretary (UD) & Director of Local Bodies, Govt. of NCT of Delhi and Ms. Debashree Mukherjee, CEO, Delhi Jal Board (DLB) for their support, participation and contribution in the workshop. CSE would also like to acknowledge the important contribution by all the participants in the workshop. The contributors touched bases on the implementation/ incorporation of efficient technologies/ measures and/best management practices with regard to energy and water nexus which the Urban Local Bodies can incorporate in the planning of the relevant DPRs.

Introduction and Objectives

The regional workshop was attended by the participants representing key functionaries from Urban Development Department of NCT of Delhi; Delhi Jal Board; Delhi Pollution Control Board (DPCC); New Delhi Municipal Council; East Delhi Municipal Cooperation (EDMC); South Delhi Municipal Cooperation (SDMC); New Delhi Municipal Cooperation (NDMC); Delhi Urban Shelter Improvement Board (DUSIB); Department of Environment, New Delhi. Other key participants included faculty and researchers from universities IIT-Mumbai, IIT- Kharagpur, SPA- Delhi; IARI- Delhi. NGOs and boards which include NJS Engineers India Pvt Ltd; NEERI- Nagpur; INTACH- Delhi; Deutsche Gesellschaft für Internationale (GIZ)- India; Alliance To Save Energy- Bangalore; Delhi Parks & Garden Society; Environmental Design Solutions; Natural Heritage First; Centre for Urban and Regional Excellence (CURE India); Central Ground Water Board, Centre Pollution Control Board.

The objectives of the workshop were:

- ❖ To generate awareness about the best management practices (BMPs), state of the art knowledge and reforms in the area of energy and resources efficiency.
- ❖ To discuss with key stakeholders the concept, issues/barriers and experiences in mainstreaming of BMPs/NURM reforms in the sustainable water/waste management area.
- ❖ To explore capacity building support required to implement projects aimed at mainstreaming BMPs and reforms in the NURM schemes.

SCENES FROM THE WORKSHOP





INAUGURAL SESSION

'Objective of the workshop and theme presentation' by Dr Suresh Kumar Rohilla, Programme Director, Water Programme, Centre for Science and Environment

Dr Rohilla gave a brief introduction about 'Centre for Science and Environment (CSE)' and the work it is doing to promote sustainable development with equity, participation and democracy. He stated that in the last few years CSE has actively started working with the government as it has realized that in addition to raising issues (activism) it is also important to find solutions (policy advocacy). He mentioned that in 2005, CSE received Stockholm World Water Prize for its policy influence in building new paradigms for sustainable water management. He said that apart from India, CSE is rigorously working across South Asian region towards sustainable development. CSE is a designated (i) **Centre of Excellence** in the Sustainable Water management area, through the Ministry of Urban Development, Government of India for research & capacity building support under the JnNURM; (ii) **Nodal centre for training of Regulators**, Ministry of Environment & Forests, Government of India; and (iii) **National hub for Knowledge reaction and capacity building**, Ministry of Drinking Water Supply and Sanitation, Government of India.



While giving a background of the workshop he said that JnNURM Phase I was started 7 years back with the aim to develop **select cities into model sustainable areas** envisaging development of slums, accessibility to drinking water, sewerage, solid waste management, roads, and street lights. However, the status (as of March 2012) is that about 73% of projects sanctioned under JnNURM I are still under implementation; the capacity of the state and local bodies to plan and implement these projects remains poor, and 5% of the total outlay of JnNURM funds are for capacity building but only 10% of this allocated fund has been utilized.

Due to the shortcomings of JnNURM Phase I, the aim of JnNURM Phase II is to **establish carbon neutral and energy efficient cities**. He emphasized the need to understand the importance of the linkage between water and energy as being the key objective for the JnNURM phase II beside the need to understand the socio-economic connect for technological interventions. He gave a comparative analysis of energy consumed in clean water production from various sources such as lake, groundwater, wastewater and seawater. He further noted that many states have hiked their electric tariffs (even as high as 37% for Tamil Nadu and Andhra Pradesh) which was highly relevant given that most of the ULBs spend about 30-50% of their revenue towards municipal water/ wastewater supply.

He set the tone by discussing the need for the Workshop:

- The public water and sewer service is getting expensive that even rich people may not be able to afford
- Energy and resource efficiency /conservation helps in lowering costs, improving the reliability of water and waste systems
- Energy and resource efficiency helps achieve environmental goals by states and communities.

He also discussed the **Challenges & potential for enabling paradigm shift under NURM**, mentioning that due to conventional system of water-sewage connection not even a single city has 24x7 water supply. The bigger the city, the more the leakage occurs and hence the need to understand that opting for centralized system causes more loss. He further stated that leakage losses as high as 30% have been observed in Goa State which add to the cost of water supply. He said the hard core reality is that nobody is thinking of plugging the losses. Everyone talks about augmentation but not about supply. **Cities are planning about water but not about waste generation. He noted that we need to rethink and develop a new paradigm as we cannot play catch up game of flush and forget.** There is a need to find new approaches which are affordable and sustainable. He also mentioned about the need to rework on water-energy nexus in urban water management by (i) fixing urban water use as we cannot be wasteful anymore; (ii) reducing energy consumption to cut costs; and (iii) promotion of local recycle and reuse waste water to close the loop.

He concluded by saying that we need objectives, indicators and standards that can be measured/monitored

and meet challenges of 'energy efficiency aimed at carbon neutral city'. Water might be a cheap source but managing it is costly along with the energy requirement. The need of the hour is to do things effectively and efficiently and we need to rework on water and energy nexus. He concluded by saying that it is important to **make water everybody's business**.

Address on 'Policy overview of energy and resources efficiency in the National Capital – Delhi' by the Chief Guest, R.K. Srivastava, Secretary (UD) & Director of Local Bodies, Govt. of NCT of Delhi



Mr Srivastava welcomed the participants for the workshop and said that everyone present in the workshop is already aware of the water issues but we need to discuss the reasons behind it. He mentioned the haphazard growth of population and the urban areas is a major reason behind the existing water issues. No meticulous planning in the implementation of the projects is also another major reason. He gave the statistics that in Delhi there are 565 unplanned colonies, 16,000 unauthorised colonies and 700 Juggi Jhopadi. He mentioned that there is a gap in the supply capacity of civic authorities and the demand, also the challenge to meet this gap is enormous. In his opinion the interceptor canal being build under JnNURM is still a hopeful project.

He emphasized on the fact that we need to devise sustainable mechanisms and policies to control the demand growth. He commented that Government is serious about the water issues and a strategic planning process is under way. He mentioned that Rain Water Harvesting (RWH) projects should be made mandatory in big and infrastructure projects. There should be atleast 10% of minimum usage of CFLs and LED lightings in any project for energy conservation. Solid and liquid waste management are going to be the focal area of concern.

He concluded by saying that we need to work towards energy and water conservation and also recycling water as it will help in reducing the cost of the energy and water services. He urged the participants of the workshop to share their experiences, take suggestions to include in the future plans and actively participate in the deliberations of the workshop. He motivated the participants to work towards making our cities green and clean in terms of plantations and water.

Address on 'Energy and resource footprint of water services' by Ms Debashree Mukherjee, CEO, Delhi Jal Board

After welcoming the participants Ms Debashree Mukherjee started her talk by expressing that we have to go a long way in water management. But our constraint is that we have to work in the given situation. She mentioned that for DJB the largest chunk of expenses after wages is the money spent for energy consumption. Thus we need to make ways for sustainable water and energy treatments. 40% of the energy used in the city is used for the pumping activity. Since DJB is not allowed to construct over head tanks a large amount of energy is spent in pumping the water for treatment and transportation.

Ms Mukherjee emphasized the need to take serious measures to improve the treated water quality after sewage treatment. Also she stressed that DJB gives more importance to the life cycle cost of the pumping machinery than the installation cost and gives added importance to the energy efficiency for at least 10years after installation. Further she informed that DJB is designing a performance measurement system on the basis of the baseline data and bench marks for energy efficiency. DJB will start reporting in the public domain in one year from now. Also DJB is redesigning the hydraulic supply system from intermittent to continuous supply system. The system is designed for a continuous supply and 17m pressure head supply.



She said that DJB is looking forward to work on pilot projects for sewage treatment and management. Ms Mukherjee stressed that new technologies need to be applied and validated which is not an easy task. The need is to assess the new developing technologies in sewage treatment claiming energy efficiency and find out mechanisms to deal with any problems that surface in implementation of these technologies. Further she informed that DJB is in the process of setting up a carbon neutral sewage treatment plant which also generates biogas. Ms Mukherjee stated that DJB reuses 40% of the treated wastewater in the city and the treated wastewater is used in lake rejuvenation like Hauz Khas, Sanjay van, horticulture, etc. While concluding she stressed that Delhi has most equitable tariff which can be calculate to about 1.4% of the average annual income of the household.

TECHNICAL SESSION 1 on Energy and Resource Efficiency in Urban Wastewater Management: BMPs and Case studies

Chair: Paritosh C. Tyagi, former CPCB; Co-chair: Suresh Kumar Rohilla, CSE

There were five presentations in the technical session which talked about the innovations and best management practices with regard to planning and execution of a sustainable waste water system.

Soil biotechnology for waste water treatment by Prof HS Shankar



Prof Shankar started his presentation by stating the applications of Soil Bio Technology (SBT) and how it can be used for different purposes such as Agriculture, Animal Husbandry, Fisheries, Sewage Treatment, Water Supply & Sanitation, Waste Water Treatment, RWH, Restoration of Rivers and Lakes. He then explained the participants about the basic chemistry of SBT behind wastewater treatment. With chemical reactions he showed that the energy in treating sewage in the water as medium takes up about 250 times more energy than treating sewage in soil as medium.

Prof Shankar explained that SBT primarily consists of laying the SBT media in layers with soil and gravel. The SBT consists of partially weathered soil-like primary minerals of suitable particle size, composition, liquid hold up, hydraulics, Geophagus worm such as *Pheretima Elongata* and bacterial culture, appropriate culture for special situations and selected Green plants particularly with tap root system. He explained the

performance of SBT including physiochemical and microbial performances. He highlighted the use of this technology for sewage treatment; industrial wastewater treatment, industrial air purification. He concluded by saying that SBT can change the face of sanitary engineering globally as it saves energy, produces oxygen and gets carbon credits.

Energy efficient urban waste water treatment using *Phytorid* by Dr RB Biniwale, NEERI, Nagpur

Dr Biniwale started his presentation by mentioning the sources of wastewater, its impact and its treatment. He mentioned the conventional treatment technologies used in wastewater treatment and their limitations. He pointed out that energy minimization is the key objective of decentralised wastewater treatment. He stated that the key challenges in conventional treatment are high maintenance in terms of cost and energy, failure due to aerators, sludge disposal, skilled manpower and *Phytorid* is a paradigm shift from the conventional treatment processes. *Phytorid* is an innovation based on international patents but is designed keeping in mind the Indian context.

The main principles of *Phytorid* are sedimentation, bacterial action, filtration, adsorption, precipitation, decomposition, nutrient uptake, vegetation system. Dr Biniwale explained the design approach of this technology. He explained each module in depth and also mentioned the



favorable plants that are used for treatment. He stated that the advantages of this technology are cost effectiveness, negligible operation and maintenance, no foul smell and efficiency of system. Some best cases of this technology were also shown. Dr Biniwale concluded the presentation by stating that this is the best technology for in-situ treatment and reuse wastewater. Also this technology can carry out on-site treatment and reuse of grey water up to 95%, which would attract total of 5 credits on Indian Green Building Certification.

Decentralized engineered wetland technology mediated sustainable urban wastewater management by Dr Ravinder Kaur, IARI, New Delhi



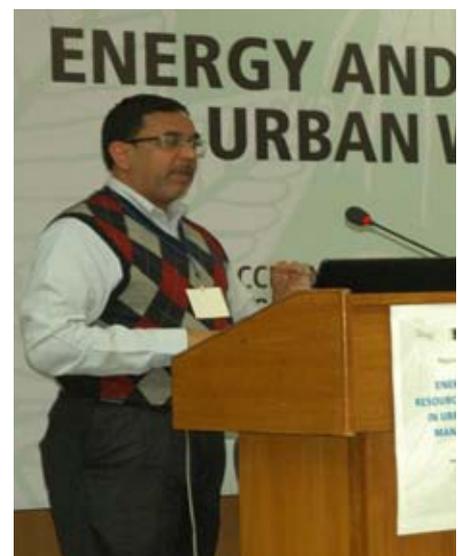
Dr Kaur talked about the limitations of the conventional wastewater treatment systems stating that energy and manpower requirement for conventional treatment is high. She explained the decentralised wastewater treatment system installed at IARI campus, New Delhi and stated that a lot of research and development is under way to make the system robust for any given condition. She stated that in order to increase the retention time of the wastewater in the system and reduce the space requirement a vertical sub surface flow system has been designed which takes up to 60% less area. She informed the efficient pollutant removal of different species of plants such as *Typha*, *Phragmites*, *Acorus* etc. used in this system and also showed the statistics of metal removal from this system.

Dr Kaur showed the best practice scenario of treating wastewater for a large sized community with a capacity of 2.2 MLD. The system is capable of reducing biological oxygen demand (BOD) from 450 mg/l to 100 mg/l; total suspended solids (TSS) from 220 mg/l to about 2.2 mg/l and heavy metals (viz. lead, iron, nickel and Zinc) by 75 to 85 %. She explained the ecological footprint and sustainability of the system in detail and mentioned that the natural based wastewater treatment technologies exert 33% less stress on the environment than the conventional treatment technology.

Dr Kaur recommended the need for eco-friendly technology for mitigating global environmental pollution & health problems due to improper sewage treatment and use of attractive solution for developing countries with scarce resources for investment in expensive centralized sewage infrastructure.

Energy footprints of waste water / reuse and recycle: Challenges and options by Dr Uday Kelkar, NJS Engineers India Pvt Ltd

Dr Kelkar talked about the technology, modules and configurations of a conventional treatment plant. He mentioned in detail the microbiological processes involved in wastewater treatment. He also explained the electricity requirement in the conventional Activated Sludge Process treatment plant mentioning that about 64% of the energy requirement is required by the aeration mechanism. He also gave the statistics for the energy demand for the wastewater treatment by plant size and operational capacity. He also explained the biofilm processed involved in wastewater treatment.



He said that we need to:

- Implement more stringent effluent requirements, including enhanced removal of nutrients and other emerging contaminants of concern that may, in some cases, lead to the use of more energy intensive technologies.
- Enhanced treatment of bio-solids including drying/pelletizing.
- Aging wastewater collection systems that result in additional inflow and infiltration, leading to higher pumping and treatment costs.
- Increase in electricity rates.

Dr Kelkar mentioned that we can achieve energy recovery by sludge digestion in activated sludge process of

wastewater treatment. He also gave a statistical summary of energy recovery potential using established technologies and stressed that resource sustainability should be achieved. He then showed the trends in Indian water cost and showed how the cost has increased in the major Indian cities. He explained the water utility scenario of cities like Bangalore, Hyderabad and Nagpur.

Dr Kelkar concluded by saying that Energy Management if adopted in Water and Wastewater utility sector along with Recycle and reuse could prove exceptionally beneficial.

De-engineering waste water: Poor as partners by Dr Renu Khosla, Centre for Urban and Regional Excellence (CURE), India



Dr Khosla started her presentation by stating that we need to make Delhi a water resilient community. Dr Khosla explained how the houses in slum areas don't have any plumbing arrangements and are too compact for toilet spaces. Also they are practically not connected with water connections. She empathized on the basic need of right of portal water and toilet for every citizen of India.

Dr Khosla presented a case study of Sata Ahevra – a re-settlement colony of 440 sq km area. The colony didn't have a piped supply of water in the master plan. The colony received water by tanker which resulted in wastage 6 times than of water supply. The solution that CURE came up with was that of Flexi Water Pipes which was simplistic but effective. Toilets were built in homes and community septic tanks were also built. This water was treated through baffled septic tank system and was reused in the central park of the area. This cost incurred in this project was 1/4th of the cost of the convention sewerage system.

Dr Khosla also presented another case study of Agra where storm water mixed with sewage water is treated through a decentralised wastewater treatment system where wetland and root zone treatment technologies were used. She concluded her presentation by saying that every drop of water is precious and we need to make it count.

TECHNICAL SESSION 2 on Energy and Resource Efficiency in Urban Water Management: BMPs and Case studies **Chair: R.S. Tyagi, Member (Drainage), DJB; Co-chair: Suresh Kumar Rohilla, CSE**

Water augmentation plan for Delhi: INTACH study findings on both energy and resource efficiency by Manu Bhatnagar, INTACH, Delhi

Mr Bhatnagar talked about how energy is required in the water utility sector. He explained in depth the demand and supply variation with the help of different scenarios considering the unsustainable scenario, sustainable scenario, worst scenario, ideal scenario and desirable scenario. He then gave the statistics of available fresh water and the water that will be available after effective treatment of wastewater for usage. Mr Bhatnagar mentioned that the constraint of Delhi's overall scenario makes it an ideal laboratory for testing innovative ideas.

Mr Bhatnagar further mentioned that in order for urban extensions to have zero discharge policy with decentralised treatment - closed water resource cycle must become the norm. He said that we also need to introduce hydrological sensitivity in the land use planning to ensure safe guarding of aquifer recharge zones. He showed different GIS maps of Delhi showing the water scenario in detail. He gave a good solution of conserving water by using the abandoned stone quarries and then transforming them into a lake leading to new ecological systems.



Mr Bhatnagar further presented the case studies of the treatment of Hauz Khas lake in Delhi by aquatic

weed treatment, Najafgarh Jheel on-channel water harvesting scheme with a potential yield of 6 MGD, Sanjay Lake at Mayur Vihar, Section wise treatment of Palam Drain. He also showed many satellite maps of many other case studies.

Energy efficiency opportunities and challenges in water supply system by Pradeep Kumar, ASE, Bangalore



Mr Pradeep Kumar started his presentation by mentioning the stake holders who are responsible to work for energy efficiency. He said that policy leaders, environmental groups, academia and business leaders need to come together to work towards achieving energy efficiency. He said that the Indian Municipal sector is the second largest in the world and consumes 4% of total electricity. He also stated that every liter of water that passes through a system has a significant energy cost, compounded by the money invested to produce it. In developing countries, the cost of energy for supply of water may easily consume up to half of a municipality's budget (40-60%) and that the 1/3 of India's urban population lacks direct access to clean, affordable and reliable water services.

Mr Kumar mentioned that water sector is an energy sensitive sector and explained the current situation in implementation of water projects. He stated that due to the lack of metering and monitoring devices in the current scenario it becomes very difficult to establish the baseline for energy auditing. He expressed that in the current practice it has become very common to install over sized pumps which again leads to high energy cost. He stressed the need to spread awareness about the over-sized pumps as every pumping station has the capacity to save 20-40% of energy which reduces the need for new infrastructure and has a payback time of 2-3 years. He also laid emphasis on the importance of having energy audit for pumping stations in order to monitor the inefficient pumps & motors; mismatch in head and flow; inadequate pipe sizing; excess contract demand and system over-design.

He also showed a very detailed breakup of the life cycle cost of an inefficient pump comparing it to that of an efficient pump and explained the cost and energy efficient interventions that can be installed in the system. He explained there are low cost measures, medium cost measures and high cost measures that can be incorporated for energy efficiency.

He presented the case studies for energy saving potential & implementation of towns in Karnataka, Andhra Pradesh and Pune, Maharashtra indicating a payback within 6 months. He also talked by giving an overview of the Delhi water supply system by DJB. He pointed towards the initiative taken by DJB such as Smart metering; Leakage management & water audit; PPP approach in NRW programs (3 pilots); Central monitoring system/SCADA in place for monitoring; NRW reduction program in place – Presently 55% to targeted for 30% (in 12th five year plan) and Promote PPP approach in the water and waste water management. He mentioned that DJB would like to cover all areas with water supply system from current coverage of 72% which means (i) implementation of new water supply projects, (ii) New pumping system, expanded pipeline (iii) Integrated sewage handling and treatments facilities; (iv) Energy price is expected to keep increasing and (v) Water tariff – continued to be lowest. All these will lead to added expenditure on energy, required more budgetary allocation. He concluded by saying that Optimization of the existing pumping system and machineries is important (*energy audit, baseline establishment-kwh/mld, efficiency improvement, better O&M practices*, etc) also Augmentation/Rehabilitation of the old pumping systems is needed (*correct sizing of pumps and motors, remove capacity mismatch in parallel operation of pumps, pipeline replacement, re-routing of the transmission mains, application of booster pumps for farthest point*). He concluded by saying that **Define energy efficiency as a “Requirement” Not as an “Option” or “Choice”**

Role of water sensitive urban design in urban water management: Sustainable options by Prof Somnath Sen, IIT- Kharagpur

Prof Somnath Sen gave a background about the projection of water scarcity in the world by 2025. He moved on to explain with statistics how in India the areas have high density of population receives high rainfall too leading to urban flooding. He then quoted the words of World Water Council that there is a water crisis today, but the crisis is not about having too little water to satisfy your needs, it is a crisis of managing water so badly that billions of people and the environment suffer badly.



Prof Sen explained the factors of Urban Water Crisis which result from dynamic use of water in urban centers, incapability of U.L.Bs to respond to the challenge, gap between supply and demand, heavy exploitation of ground water and surface resources and supply infrastructure not in pace with the existing demand. He predicted the effects that could include reduced flow and levels in rivers posing problem of water intake, declining ground water level inviting subsidence of settlements, high water surface temperature thereby increasing evaporation rate, higher outside temperature with increased use of water and A/C, lower quality of source of water resulting increase cost of treatment. He urged that we need to shift the focus from water supply city from water sensitive city. He explained the urban water management transitions framework of Brown 2009 and compared the paradigm shift toward new approach of sustainable water management.

He also explained that what has not been looked into, so far in planning the infrastructure. He then explained what water sensitive urban design is and the integrated water management cycle that are considered into it. He moved on to state the water sensitive urban design guiding principles, the factors affecting strategies and its benefits. He explained the objectives of water sensitive urban design and showed a case study of Medinipur city. He also explained the tools that can be incorporated in water sensitive urban design. He concluded with explaining a block diagram of how to get water sensitive urban design to happen and the scope of future research.

Sustainable water use in buildings role of energy and water resource efficiency in buildings by Prof Virendra Kumar Paul, SPA, New Delhi

Prof Virendra Kumar Paul mentioned that water efficiency is equal to energy efficiency. He proceeded by showing the statistics reduced water demand by achieving water efficiency with the help of reuse and recycle. He also showed the statistics of water requirement reduction causing energy efficiency. He explained the impact of recycling pointing out that (i) energy cost increases as the levels of treatment increases (ii) for residential occupancy, surplus treated water may be produced (iii) thus recycling may be effective in a only in a system involving multi-occupancy buildings at neighborhood level (iv) possible uses for recycled water: Landscaping, horticulture, HVAC, DG sets, service industry.

He explained the process of energy audit, water specific energy audit and water efficiency labeling of plumbing products. He showed the water efficient efforts taken in Europe in order to achieve sustainability and energy efficiency. Prof Paul explained the water rating process in India, its objectives and rating practices for every water spout systems and how the water and energy studies are carried out with case examples. He concluded his presentation with showing and explaining the water and energy analysis of residential and office buildings. The analysis shows that for a residential colony in spite of emphasis of water efficiency, no demand side reduction; 40% water is unaccounted as only 60% goes for recycle; Rampant use of fresh water for car washing; Dwelling level irrigation using fresh water; 480KL recycled water used daily for irrigation along with 147 KL water drawn from bore wells; Although a new project, no attempt made for use of gray water for flushing although treatment met the required standards. For office building no demand reduction due to recycling although a new project, no attempt made for use of gray water for flushing although treatment met the required standards.



Promoting Water use and resource efficiency in the urban water sector: Showcasing Hamburg city in North Germany by Dirk Walther, GIZ, India

In his presentation Mr Dirk Walther showcased the case study of Hamburg city in North Germany which implemented successful and efficient practices in achieving water and energy efficiency.



He started his presentation by explaining the components of resource efficiency that are carbon foot print, energy saving and water saving. He showed the current German scenario and the goals which were decided by Germany to meet its Kyoto protocol. He said that though Germany's economy grew significantly between 1990 and 2012 as of 2012, they achieved Green House Gas levels 25.5% below the 1990 level. This proved that Green House Gas reduction did not cause any economic slow-down. He gave the current statistics of Hamburg City and its water department which is a public utility sector. The objective of Hamburg City planning was fully energy efficiency by 2018. In wastewater treatment plants retrofitting from surface aeration to compressed air aeration was done. The bio-methane from digester gas was fed into the gas grid of the local gas supplier. Also it was utilized for bi-fuel cars and space heating.

Mr Walther explained that paradigm shift in water supply and wastewater disposal is imminent. He showed that Hamburg city incorporated black and grey water separation enabling anaerobic treatment together with other biomass and therefore production of energy on site (zero CO₂), grey water collection and treatment with membrane technology, transportation of black water with the help of vacuum technology. He concluded with explaining how this example can be studied in the interest of Indian Water Utilities.

PANEL DISCUSSION on Best Management Practises for Energy and Resource Efficiency: Potential and Challenges in target states

Chair: Debashree Mukherjee, CEO, Delhi Jal Board; Moderator: Suresh Kumar Rohilla, CSE

Revival of water bodies: Feasibility, potential and community participation by Diwan Singh, Natural Heritage First (NHF)

Mr Diwan Singh presented the case study of Naya Johad situated in Pochanpur village in Dwarka sector 26, New Delhi. This was a case of lake rejuvenation. Mr Singh explained how NHF first started with diverting the fresh water drains in the lake and removing the silt accumulated. He then showed how this helped in achieving the water levels in the lake which helped in the growth of nearby vegetation. This led to the wildlife to return back to the lake and ecology was born.

He explained that NHF then started conducting bird watching events and Shramdan events to increase the awareness in the local people. Shramdan events were organised to help in the desilting of the lake and building bunds to divert rain water in the lake. Visits by the government officials were also organised to increase the awareness of the people's efforts in government officials. He pointed out that this project helped greatly in the ground water recharge of this area. This was seen in the fact that the borewell pump pipe was actually needed to be pulled out by 2 – 3 metres. They have now proposed a new forest aqua pathway to secure this ecologically sensitive area.



Low impact urban development by Paritosh C. Tyagi, former CPCB



Mr Paritosh Tyagi pointed out that it is the duty of CPCB the water quality of Yamuna is maintained at least for bathing. He expressed that the current water transportations project are not in accordance with the increasing demand and sustainable. It is very important that we control the leakage losses in the pipe lines of the water conveyance system in order to gain public health of the community. Strengthening the water sector the country is only going to bring profits to the country. This will help in deterring the water bottle and tankers lobby. He stated that in order for us to achieve 24x7 water supply we need to strengthen the conveyance system to a state of the art level.

Mr Tyagi expressed that the possibility of total reuse of wastewater after treatment in Delhi is a distant dream considering the current incapability of the entire system to perform at its desired efficiency. The solution to the problems in the current scenario is decentralising the water utilities of supply as well as treatment. We also need to take steps that ground water is recharged continuously and its quality is maintained. He concluded by saying that every individual in the governance system be it the citizen, municipality, state or center needs to take responsibility of the utilities especially water.

Water bodies in Delhi: Issues, problem and solution by Dr SD Singh, Delhi Parks & Gardens Society, Department of Environment, Govt. of NCT of Delhi

Dr SD Singh explained the water bodies in general and their types. He then mentioned the nature of water bodies in Delhi. Delhi has village pond / johar, lakes, marshes and step well / baolis. He stated that there are total of 629 water bodies in Delhi. He explained that these water bodies right now are in danger due to reasons as intervening embankments, urbanization, Siltation and sludge deposition in the water bodies, acquisition by the Govt. for various forms of social infrastructure, sewage disposal turning the ponds in a cess pool, no awareness and concerns in the citizens regarding these water bodies.

According to Dr Singh the issues in preservation of these water bodies are that preservation of water bodies is not the mandate of single government agency. The institutional arrangements in this regard are very weak, actual areas of submergence remain unmapped and unmeasured, awareness about the surface water bodies of Delhi and their potential is extremely low and lack of proper Action Plans and constant monitoring along with follow up action. He expressed that we need to preserve these water bodies as there is a augment the declining groundwater, maintain aquatic and avian bio-diversity, to moderate the micro-climate, offer recreational possibilities, to increase soil moisture and increase vegetation growth.



Dr Singh stated that according to the high court order in 2007 all the old pipelines are to be replaced, ground water withdrawal should be regulated and RWH has to be made in mandatory in the infrastructure projects, stop discharge of sewage water in the natural water drain. He also informed the action plan that was proposed by the Delhi government to implement the court orders and its components.

He concluded by explaining the objectives and role of the Steering committee that has been formed after the court orders. The future action plans of the committee incorporate the following objectives 6th monthly report to be submitted in Hon'ble Court:

- Agency wise action plan, progress and status report along with photographs of each water bodies upon regular field visits and meeting/discussions.
- Nodal officers in water body owning agencies, Executive officer as well Plantation development officer of the water bodies and Local SDM/BDO in charge with office locations and contact no's be defined
- Steps to make a Delhi Water Bodies protection and Development Authority similar to Bangalore LDA.

Managed aquifer recharge with special reference to NCT Delhi by Dr SK Gupta, CGWB



Dr SK Gupta talked about the Managed Aquifer Recharge concept. The Managed Aquifer Recharge to ground water aims at augmentation of ground water reservoir by modifying the natural movement of surface water utilizing suitable civil construction techniques, which normally address to the issues to enhance the sustainability in areas where over-development has depleted the aquifer, conservation and storage of excess surface water for future requirements, since these requirements often change within a season or a period and to improve the quality of existing ground water through dilution. He explained the rainwater harvesting techniques that are applied in rural areas and urban areas such as gully plugs, contour bunds, check dams, percolation structures, recharge wells, storage tanks, etc.

Dr Gupta explained the ground water mapping of Delhi co-relating it to the areas of high density population and high ground water extraction rates. He emphasised that Delhi needs extensive planning and management to focus on regulation and control of Ground water development needs a complete action plan to control ground water exploitation by matching it to the extent of rain water harvesting and ground water recharge during the period, identification of all the water bodies and scientific planning for their restoration, renovation and development of catchment areas, and development of infrastructure and mechanism for utilization of treated waste water resources to meet the domestic, industrial and other non-portable water requirements. He concluded his presentation by stating that there is need for the identification of the department/ agency that will be responsible for the implementation of the measures of managed aquifer recharge.

Summing up, Vote of thanks and Way Forward by Dr Suresh Kumar Rohilla, CSE

Dr Suresh Rohilla thanked the guests and the participants to have actively participated in this workshop and its deliberations. He expressed concern over how safe is the treated sewage in the current scenario as it is not of the quality that can be directly recharged into the ground. He gave the example of the wastewater treatment infrastructure of Los Angelis, USA where the sewage water is treated to such a level that it is used to directly recharge the ground water level. He expressed that India needs to achieve this kind of confidence in its treatment quality and its infrastructure. He emphasized the need to create a conjunctive use of Ground water and Land use in the planning phase itself. He also emphasized that we need to initiate pilot projects and models. Dr Rohilla raised a series of question DJB if (i) they think they had adequate in house capacity to deal and implement the innovative practices /and technologies; (ii) would they like to partner with the central mandate to pursue these measures.

DJB, welcomed all the ideas for water augmentation and capacity development in implementing the innovative policies. Ms Debashree Mukherjee - CEO, DJB mentioned that the Government of India should encourage –

- Capacity building and financial support for validation and implementation of upcoming technologies on energy and resources efficiency in the sector of water and waste water treatment – in particular mainstreaming decentralized water management and water efficient fixtures.
- Setting up a forum of water and sewerage utilities across India for knowledge sharing on BMPs and learning on successes and challenges (if any) in mainstreaming the BMPs.

Ms Mukherjee also mentioned that DJB is planning to set up a water innovation and information centre for promoting innovative practices as well as to connect with all stake holders, agencies, universities and engineering institutes.

It was suggested that DJB can take lead in developing a time bound plan while CSE can be invited to provide technical hand-holding support and capacity building for government officials as well as all other stakeholders.