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

August 12, 2013

Venue: Hotel Ananda Inn, S.V. Patel Salai, Puducherry - 605 001

Organised by CSE, New Delhi

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Acknowledgements

Centre for Science and Environment (CSE), New Delhi in support with Government of Puducherry organized a regional workshop on 'Energy and Resource Efficiency in Urban Water Management' on August 12, 2013 in Puducherry at Hotel Ananda Inn (S.V. Patel Salai, Puducherry - 605 001).

The organizers acknowledge the distinguished guests Mr. P.R. Meena, Secretary, Public Works Department, Government of Puducherry; Dr. S. Sundaravadivelu, Special Secretary, Housing and Town Planning, Government of Puducherry, S. Raghunathan, Chief Town Planner, Town and Country Planning Department, and Mr. S. Manohar, Chief Engineer, Public Works Department. CSE would also like to acknowledge the important contribution by all the participants in the workshop. The contributors provided valuable insights that enabled the identification of the major strategic challenges and opportunities, which effectively can help the stakeholders, engineers, researchers and consultants to move towards a sustainable urban water/wastewater management system.

Introduction and Objectives

The regional workshop was attended by the participants representing key functionaries from Municipal Corporations, Public Health Departments, Water and Sanitation Boards, Ground Water Boards, Pollution Control Boards, Town and Country Planning, and local bodies of the Government of Puducherry and Tamil Nadu. Other key participants included faculty and researchers from universities (IIT-Mumbai, Anna University, Pondicherry University); institutions (National Environmental Engineering Research Institute {NEERI}- Nagpur, Auroville Centre for Scientific Research, Institut Français de Pondichéry {IFP}, Association for Promoting Sustainability in Campuses & Communities {APSCC}); Consultants (Alliance to Save Energy {ASE}- Bangalore, Environmental Engineers & Consultants Pvt. Ltd.- Delhi), and NGOs (HOPE, Sembadugai Nanneeragam) involved in the advocacy of sustainable urban water and wastewater management in the target states (Puducherry, Tamil Nadu, Karnataka, Kerala and Andhra Pradesh) of the workshop.

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


Regional Workshop
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URBAN WATER MANAGEMENT


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INAUGURAL SESSION

Welcome Note: Dr. S. Sundaravadivelu, Special Secretary, Housing and Town Planning, Govt of Puducherry, India

A brief welcome address was delivered by Dr. Sundaravadivelu where he welcomed the participants from Municipal Corporations, Public Health Departments, Water and Sanitation Boards, Ground Water Boards, Pollution Control Boards, Town and Country Planning, and local bodies of the Government of Puducherry and Tamil Nadu.

He noted that the present workshop was highly relevant and important especially for Puducherry area given the fact that the state has become 'water stress state' from 'water rich state' within a span of ten years. He encouraged the participants to actively participate and imbibe knowledge for sustainable water/wastewater management, and channelize the learning towards the formulation of the forthcoming water policy for the state of Puducherry.

Welcome address, about CSE and Objective of the workshop presented by Dr. Suresh Kumar Rohilla, Programme Director, CSE

Dr. Rohilla gave a brief introduction about CSE and the work it's doing in raising awareness, research, advocacy & communication, education and training. 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 CSE has received Stockholm World Water Prize in 2005 for its policy influence in building new paradigms for sustainable water management.

He stated that the aim of JNNURM I was 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 of phase I is that about 73% of projects sanctioned are still under implementation (as on March 2012), failure to adopt service level bench marks; lack of adequate capacity in states & mission cities; and the capacity of the state and local bodies to plan projects and implement these projects remains week. He said that due to the short comings of JNNURM phase I, phase II has been deferred for three years and has been aimed at the establishment of smart cities which would be totally carbon neutral and energy efficient. He also mentioned that phase II insists on time-bound action by all states in particular focus on water too be saved and better managed.

Further he stated that the need of the hour is to provide water to every citizen but one needs to be prudent in water supply as the public water and sewer service is getting expensive as we have this mindless game of **'flush and forget'**. Also he stressed the need to focus more on **'Energy and resource efficiency/conservation'** as it helps in lowering costs, improving the reliability of water and waste systems as well as helps achieve environmental goals by states and communities.

Giving a brief overview of the objectives of the Workshop he concluded by saying that future urban hydrology needs to be an integrated planning process involving hydrologists, geologists, biologist, planners and engineers.

Special address by the Chief Guest Mr. P.R. Meena, Secretary, Public Works, Govt. of Puducherry

Mr. Meena gave a policy overview for **'Energy and resource efficiency in urban water management in Puducherry'**. He said that there is a need for proper planning for JNNURM phase II projects. He talked about the two NURM projects within the state of Puducherry, one in water supply (20 KLD) and other in comprehensive waste water treatment (17.5 MLD) in Yanam and Karikal, respectively, both of which are near to completion. He stated that Puducherry has the lowest tariff for water and power. However, they are working to revise it on the basis of the parameters fixed by JNNURM and the guidelines set for monthly charges by the Ministry. He also added that these revisions have faced huge criticism and opposition from the public. He also pointed towards the excessive use of ground water in Puducherry due to which all the tanks and lakes have to be exhausted. He emphasized the need for proper sewage treatment plants so that treated water can be reused for agriculture purposes.

Target state presentations on the Overview of NURM water/wastewater projects: Existing and proposed reforms/BMPs for energy and resource efficiency – (Puducherry, Tamil Nadu, Andhra Pradesh, Karnataka, Kerala)

Dr Mahreen Matto from CSE gave an overview of the JNNURM phase I projects under the water/sanitation sector in the target states of Puducherry, Tamil Nadu, Andhra Pradesh, Karnataka, and Kerala. She stated that of all the projects undertaken under the Phase I more than 50% are in the water sector. She also pointed out that there is a huge gap between the numbers of projects sanctioned to the number completed. She talked about the projects of Karnataka, Andhra Pradesh and Kerala stating that although in water sector Karnataka and Andhra Pradesh have done quite well, there are still some short comings. To name a few, the projects have failed to achieve service level bench mark of full cost recovery and they primarily focus on hard ware like setting up of new sewage plants with no project focusing on plugging of leaks and losses in the existing structures.

V. Bhuvaneshwaran, Puducherry gave an overview of the two ongoing JNNURM projects in the water sector. One is the comprehensive sewage system which is 70% complete will be operational by March 2014. The second one, the Yanam water supply project he stated is almost 90% complete and will be operational by December 2013.

S. Amalraj, Tamil Nadu talked about the combined water supply scheme in water scarcity region of Vellore which will bring water from 240 km away to the city. He stated that the project meest the energy efficiency demands in terms on minimal use of pumps and motors used. SCADA was linked to all pumping stations with reservoir water levels.

S. Manohar (Chief Engineer, PWD, Puducherry) concluded the session by saying that two main important subjects of a developing city are pollution and cleanliness. It's important that every state seriously treat and reuse water.

Technical Session on Energy and Resource Efficiency in Urban Water Management: BMPs and Case studies

In the technical session there were four presentations talking about the innovative techniques and best management practices for achieving energy and resources efficiency in sustainable urban water/waste water management.

Dr Nidhi Pasi (CSE) set the tone of the session by giving an overview of the **'Approaches and practices for energy and resource efficiency in water management'.** She said that the present water paradigm is inefficient with the water being supplied to the city from further and further away, and simultaneously flushing the wastewater out of the city far and further away; making th e process energy intensive. She pointed out that energy consumption in most water systems worldwide could be reduced by at least 25% through cost-effective efficiency measurements/techniques. She said that in the developing countries cost of energy for supply of water may easily consume up to half of municipality's budget thus end up spending an estimated 30-40% of their annual expenditure towards energy charges.

She concluded by saying that there exists enormous potential for improving resource/energy efficiency in water management and stressed on the need to think holistically and move from electromagnetic to natural system for a sustainable growth. She classified the measures to be undertaken as preventive (measure for water conservation and water sensitive planning), curative (shift to decentralized natural systems such as SBT and constructed wetlands) and reactive (improving existing system efficiency itself).

Mr. Pradeep Kumar, ASE, Bangalore gave a presentation on 'Energy efficiency opportunities and challenges in water supply system'

Mr. Kumar said that there is a close nexus between energy and water. He stated that every liter of water that passes through a system has a significant energy cost associated to produce it. He further mentioned that in developing countries, this energy cost is the key cost for any municipality supplying water as it's the second highest cost after human labor. He stated that according to the present water paradigm, water supply is energy intensive with energy being used in various stages of operation like extraction, treatment, transport, etc. Talking about the water scenario in Indian cities, he said that the cities are facing lot of challenges in the area of energy efficiency due to lack of technical, managerial and financial capacity to implement projects; lack of metering & monitoring systems; high rates of unaccounted for water and unreliable water services. He said that the key reasons for poor efficiency is over design, unrealistic use of factor of safety

margin, efficient component NOT installed and/or operated properly, and inadequate metering / monitoring.

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 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 mentioned that the estimated energy saving potential for the water supply system of Puducherry is about 20-25%. Mr. Kumar further stated that although the state water policy that is under finalization has good linkages with the NURM objectives, it lacks links with energy efficiency component and consequently need to be adapted accordingly.

Prof. H.S. Shankar, IIT-Mumbai gave a talk on 'Use of soil biotechnology for waste-water treatment'

Prof. Shankar stated that Soil Bio-Technology (SBT) is a comprehensive technique using soil and water to create a green technology to treat the wastewater. He declared that the efficient solution lies in the mathematics of ecology as soil biotechnology uses soil to purify water using less energy and integrates with the natural cycles of the environment. He stated that process of treating wastewater in soil environment is a highly energy efficient process while in water environment it is high energy intensive, which is the fundamental for SBT. Prof. Shankar mentioned that the energy consumption is about 500 kJ/g live C in water habitat as compared to 3 kJ/g live C in the soil habitat. He further noted that the current knowledge clearly indicates that terrestrial/soil systems have high population densities for microbes (and hence higher oxygen availability) compared to water ecosystems. However, Prof. Shankar stated that most of the current wastewater treatment technologies make use of aquatic ecosystems where we need more energy for oxygen supply or aeration. And this forms the fundamental basis of an energy efficient SBT for wastewater treatment.

He said that apart from the right soil this technology needs microbes to process the organics in the waste, stating that the aim is to construct an ecosystem which resembles nature for purification of waste water. He said that it takes 8 hours to purify water and produces clean water with no foul smell and sludge. The treated water can be used for horticulture. He said that soil biotechnology can change the face of sanitary engineering globally as it saves energy, produces oxygen and gets carbon credits. He highlighted the use of this technology for sewage treatment; industrial wastewater treatment, industrial air purification. When questioned about the economics of the SBT plant, he stated that a SBT plant was much cheaper than conventional treatment systems and the power consumption was about 0.2 kWh/1000gallons as compared to 2 kWh/1000gallons for activated sludge process. He also noted that even if a SBT plant remains unused for a year it will give fantastic results which is not the case in electromechanical treatment systems.

Dr. R. Biniwale, NEERI, Nagpur spoke about the 'Energy efficient urban waste water treatment using Phytorid'

Dr Biniwale said that a decentralized system of treatment is proficient as it is energy efficient, improves reachability and treatment where-ever needed. He highlighted the need for transition from **'command and control'** to **'ecosystem based approaches'** for wastewater treatment. The **Phytorid** technology developed by NEERI is based on this approach. The Phytorid system is essentially a constructed wetland, highly energy efficient in terms of waste water treatment. He said that the technology is based on topography, cost issues; O&M practices and has a capacity of more than 1000MLD.

The Phytorid system is divided into three treatment zones:

- Primary Settling Cell (PSC) for the purpose of anaerobic pre-treatment of suspended solids.
- Secondary Advanced Filter Cell (SAFC), that supports a permutation of different sizes of stones and gravel, wherein anaerobic digestion occurs.
- Tertiary Biological Wetland Cell (TBWC) made up of different layers of life supporting media such as those used in SAFC and planted with aquatic flora such as *Typha, Scirpus, Cyperus, Peltandra and Phragmites*. These plants are rooted plants that directly absorb nutrients from wastewater and do not need a soil medium for growth.

He concluded his presentation by highlighting the advantages of the system such as BOD removal efficiency of 80-95%; *Coliform* reduction from 10^6 to 1000; low operation cost as unskilled operator can manage the plant; minimum electricity requirement; nearly fossil energy free; smaller footprint with retention time of typically less than 24 hrs; tolerance to fluctuations in operating conditions such as flow, temperature and pH; odor less operation; etc.

Mr. P.Z. Thomas, Environmental Engineers & Consultants Pvt. Ltd., New Delhi gave a lecture on 'Water neutral and energy neutral and low impact urban development in buildings'

Mr. Thomas pointed out that in building construction and in infrastructure works, lot of natural resources like water, building materials along with energy (power/electricity) etc. are required. He stated that these developmental works can be of high impact or low impact. The developmental projects which do not engage in any resource conservation practices, or the projects which severally affects the project site and its surroundings are categorized as high impact developments and vice versa for low impact developments. He discussed the low impact development with respect to water in construction project part of his presentation. He said that on the basis of daily water consumption for domestic purposes, a reduction in the conventional consumption can be made in clothes washing and flushing up to 62% and 53% respectively. Also in case of sewage generation, a reduction of 160 KL can be achieved.

This in turn reduces the water pumping cost. He mentioned that source of water for low impact developments can be public supply, own source or a combination of both. He said that there is always a limitation in the supply of sufficient quantity of public water supply. The project proponents to balance this deficit resort to other mean such as digging open well, deep bore well/tube well, ponds etc. Mr. Thomas stated that the project proponents can actually tap rain water for developmental purposes with minimal treatment like filtration & disinfection. Moreover, rain water can also be used for portable purposes. In places, where the ground water table is high and recharging of aquifers through rainwater harvesting pits is not feasible, rainwater storage tanks, or large collection ponds can be proposed. The stored rainwater can be a source of water during non-rainy days. He concluded by saying that states like Kerala and Puducherry largely depends on ground water, hence the need to conserve this resource through rainwater harvesting/recharge.

Panel Session on 'Mainstreaming energy & resource efficiency in sustainable urban water management'

Chair: Dr. Suresh Rohilla, CSE

Lalit Kishor Bhati, Architect-Urban Planner, Auroville gave a lecture on 'Sustainable Urban Planning towards people & environment friendly inclusive urban development'

Mr Bhati said that in order to solve the problem there is a need to change the mindset. He noted the need for sustainability in the planning process and a comprehensive integrated water planning for any city. He gave the example of sustainable planning of Auroville and the various planning tools used for land use development. According to him, the cities need to be eco-productive with water as integrated component. He highlighted the best practices which Auroville has used in almost every sector of city management.

The Chair for the panel session further emphasized that land use planning does indeed play a very important role in water management.

Gilles Boulicot, Auroville Centre for Scientific Research talked about 'Surface water as a resource: Taking Auroville as an example'

Mr Boulicot said that Auroville depends entirely on groundwater for its water consumption. Groundwater resources are continuously declining, with the threat of turning saline due to sea water incursion. In order to create a reliable and secure access to water, Auroville has adopted to multiple sources of water strategy using rainwater, desalination and groundwater in combination with water saving and recycling practices. He said that systematic implementation of water saving practices, recycling and reuse is essential to ensure Auroville's future

in this water stressed context. He highlighted the huge potential of RWH as a source for water supply to the city. However, he noted that this needs to be planned and integrated within the city lay-out.

He mentioned that due to urbanization increase in surface run-off has occurred, which can be collected/ stored and become the main source of water for the city. It is wise to plan, invest and implement infrastructure in relation to demand and population growth. Mr Gilles carried a study adopting a 20 year timeframe for infrastructure planning, with a maximum population of 15,000 (10% growth) and the corresponding runoff and water demand. The outcome was that the best combination of fresh water sources for all criteria is 80% surface water and 20% desalinated brackish water. A backup of 5% of the yearly demand is ensured from protected fresh groundwater. The study results show that a 300,000m^3 storage tank supplied by an appropriate drainage system is sufficient to supply 95% of the annual water demand for the population.

Prof. Devi Prasad, Pondicherry University gave a presentation on 'Peri-urban water markets as an instrument for managing urban water supply needs'

Prof. Prasad in his talk said that urban water needs can only increase in the immediate future. What happens to states which depend on ground water like Chennai and Puducherry? Is desalination an alternative option? He said that the answer to the above questions is water marketing which plays a vital role enabling to trade of water or rights over water (as a commodity). He mentioned that it is presumed that players are *willing participants*. Water is sold by those who have a disposable surplus to those who are in need. He added that water markets don't mean that water is sold and purchased in terms of money, the exchange could be informal – payment good be in terms of goods/services/sharing harvest. He mentioned that the approach is to persuade agriculture shift to crops/methods with less water requirement; persuade them to sell water and obtain greater "profits" and persuade consumers to "pay" for water they consume.

Prof. G. Poyyamoli, Pondicherry University gave lecture on 'Water footprint for sustainable management of water resources in Puducherry urban area'

Prof. Poyyamoli in his talk defined footprint family (ecological/carbon/water) as a set of indicators characterized by a consumption approach which is able to track human pressure in terms of appropriation of ecological assets, GHGs emissions and freshwater consumption & pollution. The water footprint of a nation is defined as the total amount of water that is used to produce the goods and services consumed by the inhabitants of the nation.

He explained that the water footprint of a nation has two components; (a) the internal water footprint which is defined as the water used within the country and (b) the external water footprint of a country defined as

the annual volume of water resources used in other countries to produce goods and services imported into and consumed in the country considered. He mentioned that 'Water use' is measured in terms of water volumes consumed (evaporated) and/or polluted. The water footprint is a geographically explicit indicator, not only showing volumes of water use and pollution, but also the locations and timing of water use.

He said that the total water footprint of a product breaks down into three components, Green water footprint, Blue water footprint and Grey water footprint. He concluded by saying that by making rainwater more productive causes lowering of green water footprint. Supplementary or deficit irrigation & application of precision irrigation techniques causes lowering of blue water footprint and moving towards organic farming zero's grey water footprint.

Nandhi Muthu, Pondicherry University gave a presentation on 'Water footprint as a tool for sustainable management of ground water resources in Pondicherry University, Puducherry, India'

Mr Muthu in his presentation said that the World Business Council for Sustainable Development (WBCSD) developed the Global Water Tool, and launched it by 2007. The same was adopted by Puducherry University on September 2011 to calculate its "WATER FOOTPRINT".

He said that Puducherry is under water scarcity with 200 cubic meters of annual per capita of renewable fresh water availability. Government's vision for 2020 clearly describes the water management problems such as ground water depletion, salt water intrusion, industrial pollution, sewage pollution, etc and has called for the attention of educational and research institutions to supplement their effort on minimizing water related issues of the State.

Mr. Muthu said that while assessing the water footprint of the Pondicherry University campus it was found that each day approximately more than 5.5 lakh liters ($550m^3$) of water is extracted from the aquifer for the residential activities alone, which constitutes the main blue water footprint of the university, apart from the service sectors and other agricultural activity. He said that approximately 52,665 cubic meters of blue water per year can be produced, if the rain water is harvested and managed, approximately 19,822 cubic meters of blue water per year can be produced. Therefore the total potential for water that can be generated/produced within the campus will be 72,487 cubic meters of blue water per year. Based on the calculated production of blue water within the University Campus, the anticipated potential percentage of reduction in ground water withdrawal is 46.25%. He ended his talk by saying that if the withdrawal is minimized by carefully managing the water resources, the availability of ground water will be **"retained and sustained for the future generations demand"**.

P. Joseph Victor Raj, Director, HOPE gave a lecture on 'Protection of water and water resources'

Mr Raj highlighted the measures which must be taken in order to protect water. (a) He said that water should be considered as both right and commodity; right for the domestic consumers and commodity for the Industries. (b) Keeping in mind the present status of water the duration of water supply to the domestic consumers should be reduced from 10 hours a day to 7 hours a day. (c) The government should increase the water tariff for industrial use and ban water-intensive industries. (d) Government should not give subsidy for mere use of water; subsidies should be given for recycling and reuse of water. (e) Need for convergent efforts as water is dealt by different departments like PWD, Agriculture, Science, Technology and Environment, etc. There should be convergent efforts to protect this precious resource; or a separate Department could be created for Water.

He also discussed the measures to be taken for protecting Water Resources. He said that the Puducherry Draft Water Policy is still a draft as tourism is considered as an industry but it seems to surpass everything. Converting Bahour Lake (one of the two major lakes of Puducherry) for tourism purpose should be stopped immediately. Out of the 84 tanks rehabilitated with a cost of Rs 35 crores between 1998 and 2008, almost half have become defunct or encroached. The need of the hour is that the government should not work on a **project mode** but on a **continuous basis**. He emphasized on the importance of promotion of Rain Water Harvesting; improvement of Drainage Management and removal of encroachments near drainage.

V. Radhakrishnan, SGWU-cum-Joint Project Co-ordinator, PWRO, Puducherry talked about 'Status of water resources in Puducherry: Behaviour of ground water, methods of rain water harvesting and water conservation'

Mr. Radhakrishnan talked about the water resources of Puducherry. He gave a geographical overview of the state, stating that Puducherry is bounded by two seasonal rivers and has 86 system and non system tanks, in addition to around 500 small water bodies with three different physiographic units, which provide natural recharge to the aquifers. He said that the main aquifers that contribute groundwater in Puducherry are i) Alluvial Aquifer ii) Cuddalore Sandstone (Tertiary Aquifer) and iii) Vanur & Ramanathapuram Sandstone (Cretaceous Aquifer). He also mentioned that that the groundwater levels in most of the areas have started to decline, however the Government of Puducherry has taken remedial measures to increase groundwater potential & quality by (a) rehabilitation of the 84 tanks so as to increase their water holding capacity from 45 to 75 MCM with European Union assistance. (b) 25 of the check dams have been constructed across the river courses to impound the flow during the monsoon period. (c) roof top RWH structures have been provided in almost all Goverment buildings; (d) Considerable number of village ponds were rehabilitated to increase their water holding capacity and

Recharge Tube wells constructed in the desilted ponds; (e) 100 % subsidy assistance is being extended to renovate the defunct dug wells and dug cum bore wells in the farmers lands for harvesting rainwater; (f) A novel scheme “Precision farming “ was introduced by the Department of Agriculture from the Current financial year onwards for conservation of water; (g) Farmers are educated to cultivate low water consuming crops, adopt drip irrigation for sugarcane crops & adhere to SRI technology in paddy cultivation for minimizing the crop water requirements.

He concluded by saying that the Government of Puducherry has made it mandatory to construct roof top rainwater harvesting structures in government buildings, private industrial and institutional buildings and is working on the desilting/renovation of percolation ponds and construction of recharge tube wells in the renovated ponds & construction of recharge shafts in the river beds.

Aravindan Govindassamy, Sembadugai Nanneeragam gave a lecture on ‘The source of water in Pondicherry region and future demands of people’

Mr. Govindassamy said that there are three main water sources in Puducherry; river system, water bodies and rainfall but due to improper extraction there are water use and management issues. He said that due to the population explosion and consequent enhancement in consumption has driven the ground water source level to sink further. He mentioned that due to lack of awareness among the masses, the excessive ground water exploitation has resulted in intrusion and percolation of sea water, turning ground water saline, also many chemical industries licensed and set up early in the region are responsible for the poor quality of ground water (alkaline and acidic) at some places.

He mentioned that at present the available water is much polluted, efforts are not taken for pollution treatment and recycling. Even the solid wastes are not subjected to the process of recycling, they are dumped at particular place, get drenched in rain water continuously, seep into the ground and percolates into the ground water affecting quality. It’s important that the water polluting industries be instructed to set up water treatment plants and put them into beneficial use. He stressed on the fact that at any cost industrial and hospital wastes should not to be allowed to discharge into the public drainage systems. Segregation and recycling activities have to be carried out with intense interest. Otherwise, the quality of ground water will totally be unsafe and unfit for usage which will in turn aggravate the problem of diseases.

Further he said that RWH as plan of action should be implemented by individual households, Government departments and private enterprises, so that the sea water intrusion could be checked and driven out back to its destination and also help increase the level of ground water by the method of proper management. He said that in recent years, the marked shift in land usage from agriculture to land sites for housing purposes, has adversely affected the use of water in the surface for farming and percolation into the ground.

He ended his lecture by saying that to this noble task, Government departments, NGOs, Hydrologists, Ecologists, Executive member of civil society, Engineers, media persons and other Stake-holders etc., have to converge in a seminar or workshop or brain storming sessions, and discuss the problem / issues and arrive at a solution / or ascertain remedies.

Dr. Suresh Rohilla concluded the session by saying that preservation of water bodies and land use planning is important keeping in mind our future generation. He also mentioned that water is not ONLY engineers business but everybody's business. He further said that NO city should depend on only one source of water supply but on multiple sources. A BACKUP plan should be in hand.

Panel Session on 'Mainstreaming Energy & Resource efficiency in sustainable wastewater treatment'

Chair: Lalit Kishor Bhati, Auroville

S. Manohar, Chief Engineer, Public Works Department talked about 'Wastewater treatment in Puducherry: An overview'

Mr. Manohar gave an overview of the urban water supply system scenario in Puducherry. He emphasized on the fact that there is a need for source augmentation scheme. As over extraction of ground water has caused intrusion of sea water which has attributed to change in water quality. Thus, it is proposed to augment surface water from Oussudu tank which will reduce some thrust on underground water. The scope of the scheme is to draw 20 MLD of raw water from Oussudu tank; conveying the raw water to the proposed treatment plant site at Muthirapalyam head works (4 km); treating the raw water at Muthirapalayam head works site and pumping the same after chlorination at Oussudu. He mentioned that before proposing the project all the parameters in terms of drinking water were taken into consideration by consulting suitable consultants from TWAD, Chennai. It has been found that no traces of heavy metals are found in the lake water.

Tency Baetens, Auroville Centre for Scientific Research gave a lecture on 'Decentralized urban wastewater management'

Mr Baetens said it's been a 30 year journey which Auroville took in order to develop a technology for the waste water management. The waste water is treated via Decentralized Waste Water Technology system (DWWTS) with vortex system for tertiary treatment. The DWWTS has the ability to reduce the total pollution around 90% and meet the CPCB standards. However the effluent still has an odour which is removed by using votex system where water swirls and is accelerated for oxygen saturation. The spiral movement of water has a direct impact on the dissolved oxygen content and supports the release of gases which cause bad odors in anaerobic treated waste water. As a consequence of increased oxygen content the chemical oxygen demand (COD) and biological oxygen demand (BOD) drop drastically, reduction of nitrogen, *coliforms* and colloid formation are also observed. After 2 to 3 hours, water is saturated and becomes ordour less. The cost of the system is comparable to the conventional system, the entire system doesn't require high energy, inputs of chemicals or complex maintenance procedures. The system has been successfully installed in many

places across India like in Aravind Eye hospital (Puducherry) having a capacity of 500 m^3/d and VBHC Bangalore with capacity of 740 m^3/d.

Prof. M. Vikram Reddy, Pondicherry University discussed the 'Urban water quality management with reference to Urban Lake water quality restoration and management in India'

Prof. Reddy talked about the water quality which is defined as numerical description of physical, chemical and biological conditions of a water body. It is a measure of water body's ability to support beneficial use (ecosystem services). He said that all lakes are polluted by nutrients. Nutrients are usually present in small amounts in the natural aquatic systems (or unpolluted waters), which are essential for maintaining a balanced ecosystem. But, these nutrients are present in abundance in municipal sewage & wastewater, and agricultural runoff. Municipal sewage (MS) depletes the DO, causes severe increase in BOD and contributes various pathogens into the receiving water bodies. He said that according to CPCB, about 74% of MS generated in cities and towns in India is released untreated into urban lotic & lentic systems.

He highlighted ways to prevent the entry of waste into the water bodies by (a) using physical barriers which prevent the entry of sewage into the lakes like in case of Husain Sagar Lake; (b) by phytoremediation which is defined as the engineered use of green plants (including microbes) for decontaminating waste-water. He said that the technology can reduce cost, restore habitats and clean up pollution in situ or ex situ. Water hyacinth (*E. crassipes (Mart.*)) is an appropriate plant for this purpose which is ecologically very useful as a filtrate.

Hilal F. Fardin, Social Sciences Department, Institut Français de Pondichéry talked about 'Major constraints of wastewater management in Puducherry area'

Mr Fardin study focused on the contrains of the wastewater management of the northern part of Puducherry area namely Karuvadikuppam, Auroville, and Alankuppam. He said that various methods have been used for this study including water tests of physico-chemical and bacteriological parameters; spatial analyses and biogeographical surveys (mainly about plant species) and socio-economic surveys. He mentioned that although the treatment techniques/technologies are efficient but some technical dysfunctions occurs frequently due to contamination by outer elements (e.g. sold waste); lack of adequate materials and tools for O&M and Quasi-absence of O&M of most of the sites, generating clogging of the systems. Also distance from the city and elevation of the STP site can add to the problem. These techno-spatial factors are mainly due to low land availability, but also to some societal characteristics absence of training of the persons in charge of the O&M; lack of technical skills of these very persons and lack of sanitarian awareness.

He concluded by suggesting the options for **WAY FORWARD**:

- Canal restoration with the help of ecological engineering (phytoremediation techniques) could level up the quality of urban water and reduce the contamination of environment.
- Some of the socio-technical limits of wastwater management can generate sanitarian risks, in particular for the riverain populations, but moslty for the persons in charge of the O&M.

Celina Jauzelon, Social Sciences Department, Institut Français de Pondichéry gave a presentation on 'Puducherry urban asset planning programme ; Testing a participatory methodology in development studies'

Ms. Jauzelon gave an insight about Global Urban Research Centre (GURC) which is a multidisciplinary centre focusing on urbanization, poverty, inequality and exclusion. The principal objective is to carry out a pilot research on Asset Planning (AP) in poor communities of southern countries and test the tools and methodology developed. AP aims to improve poor community's response and negotiation capacity to address their priority problems and needs to generate new opportunities for the poor inorder to strengthen, accumulate, rebuild and adapt their portfolios of assets. She said, in case of Puducherry, evaluatation and understanding of AP through a participatory planning process at the community level is important in order to explore local perceptions of well-being/ill-health, especially in relation to the "physical lived environment"; explore the matrix of interrelationships between ill-health, local conditions and other assets/resources/ capabilities; seek potential strategies for enhancing the community's capabilities to address needs within this domain; and assess the effectiveness of this methodology through follow-up monitoring.

WAY FORWARD

The workshop was concluded by a brief sessions on "Way Forward' which was lead by Dr Suresh Rohilla, CSE and S. Raghunathan, Chief Town Planner. They said that lots is happening in the field but the stakeholders need to have a vision and an integrated plan as nothing can be taught but everything can be learnt. All institutes need to be planned in such a way that sustainability is in their curriculum. The stress was on the need to provide capacity building programmes to promote decentralised water/waste water management systems and an extended arm of assistance to be provided by institutes of Centre of Excellence to the ULBs so that these aspects are incorporated in the planning and implementation of the relevant DPRs.