



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

September 27, 2013

Venue: Goa International Centre, Dona Paula, Goa – 403 004

Organised by CSE, New Delhi

Supported by:

CCBP NURM, Ministry of Urban Development, Govt of India
Urban Development Department And Directorate of Municipal Administration, Govt of Goa

Acknowledgements

Centre for Science and Environment (CSE), New Delhi in support with Urban Development Department and Directorate of Municipal Administration, Government of Goa organized a regional workshop on 'Energy and Resource Efficiency in Urban Water Management' on September 27, 2013 in Goa at 'Goa International Centre', Dona Paula, Goa – 403 004. The organizers acknowledge the distinguished guests Adv. Francis D'Souza, Deputy Chief Minister; Elvis Gomes, Director, Municipal Administration; S.T. Putttaraju, Town and Country Planning; J.J.S. Rego, Chief Engineer-I, PWD, Government of Goa, and A.M. Wachasundar, Project Director- JICA. 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 with regard to energy and water nexus which the ULBs 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; Directorate of Municipal Administration; Water Resources Department; Public Works Department; Department of Science, Technology & Environment; Goa State Pollution Control Board (GSPCB); Energy Development Agency (GEDA); Goa State Council of Science and Technology, (GSCST) and Goa State Urban Development Agency and local bodies of the Government of Goa, Gujarat and Maharashtra. Other key participants included faculty and researchers from universities (IIT-Mumbai, IIT-Kharagpur, Goa University); institutions (Birla Institute of Technology & Science [BITS] Pilani- Goa and The Energy and Resource Institute [TERI]-Goa); Consultants (Alliance to Save Energy [ASE]- Bangalore, CDDS-Bangalore, Moziac Design-Goa, Digital & Environmental Solutions Pvt. Ltd-Goa, Detritus Solutions-Goa, Concept Biotech-Gujarat), and NGOs (Goa Civic & Consumer Action Network [GOACAN]) involved in the advocacy of sustainable urban water and wastewater management in the target states (Goa, Gujarat, Maharashtra, Madhya Pradesh and Rajasthan) 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





INAUGURAL SESSION

Welcome Note by Elvis Gomes (Director, Municipal Administration, Government of Goa, India)

Mr. Gomes inaugurated the workshop by welcoming the governmental and nongovernmental officials (universities, NGOs, institutes and private consultants/practitioners) across the western zone of JnNURM.

He said that it's a special day for the state of Goa that such a workshop is being organized in the state and the deputy Chief Minister is present to grace the occasion. He thanked CSE for taking the initiative towards Urban Water Management. He said that now it is up to the participants what good they imbibe from the workshop and how they take it to the next level.



Touching the base on JnNURM Phase I, Mr. Gomes said that although the JnNURM Phase I came late to Goa, we still have managed to get a DPR approved for a water supply project.

Dr. Suresh Kumar Rohilla (CSE) gave a presentation about CSE and the Objective of the workshop



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 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.

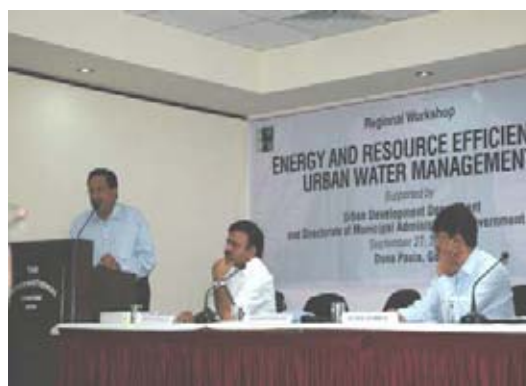
He also discussed the **Challenges & potential for enabling paradigm shift under NURM**, mentioning that due to conventional system of water-sewage connection not even a single city has 24x7 water supply. The bigger the city, the more the leakage occurs and hence the need to understand that opting for 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'. The need of the hour is to do things effectively and efficiently. He concluded by saying that it is important to **make water everybody's business.**

Special Address by the Chief Guest Mr. Francis D'Souza, Deputy Chief Minister, Government of Goa

Mr. D'Souza congratulated CSE for taking the initiative to get the relevant stakeholders together at one platform and discuss the issue of water and sanitation.

He stated that for any action to succeed all the stakeholders need to work together, understand together and find solutions together for the problem to be solved. He mentioned that 30-40% leakages losses are not acceptable and consequently, Govt. of Goa through JICA has started an initiative to study the existing system in the state with the goal of developing a new improved efficient system for water/sanitation.



He also mentioned that although water supply isn't a big issue in the state they still haven't been able to implement the 24x7 target. He noted that in spite of Goa being number two in the list of developed states in India and being a small state they have still not been able to handle certain issues and have lacked the foresight to manage issue of water supply and sanitation. He said that Goa needs to improve the basic infrastructure like sanitation and supply water 24x7. Therefore he felt, it's important to learn about preparation of CSP, implementation of BMPs, preparation of DPRs, etc. He stated that urbanization rate in Goa is very high even though only 14 local bodies exist in Goa. The difference between municipal council and village local bodies was minimalistic. He concluded by saying that the state needed to achieve international standards for water and sanitation issues in the state.

Dr. Mahreen Matto (CSE) delivered a lecture on the Overview of NURM water/wastewater projects vis-à-vis energy and resource efficiency in urban water management



Dr. Matto gave a general overview of the total number of projects sanctioned and completed in the water sector (under JnNURM Phase 1) across India. She pointed out that there was a huge gap between the sanctioned and completed projects in every sector. She said that overall states like Gujarat, Maharashtra and Andhra Pradesh are doing very well. As of 2013, total number of sanctioned projects for Maharashtra has been 86, which is the highest but the execution of these projects has been slow. On the other hand, states like Gujarat have fared better, with 50 projects completed out of the total 77 projects sanctioned; while Andhra Pradesh has executed 23 of the total 52 projects. She

also mentioned that under JnNURM, in order to receive funds for the approved projects the state needs to implement reforms pertaining to governance and other mandatory reforms. As of 2012, Gujarat led the tally for the state level reforms, being the only state to have achieved all 10 reforms required by the mission.

She stated that although states like Gujarat and Maharashtra have been progressive in water sector but shortcomings do exist under the JnNURM programme. For instance, most projects focus on hardware and largely have failed to achieve the service level bench mark of full cost recovery.

She concluded by saying that in view of the theme of the workshop there are no concerns related to energy in the existing or ongoing schemes; holistic water management is still missing as none of the projects are sanctioned which look at the combination of water and sewerage, nor water conservation and efficiency.

Target state presentations (Goa, Rajasthan, Madhya Pradesh, Gujarat and Maharashtra) - Overview of NURM water/wastewater projects: Existing and proposed reforms/BMPs for energy and resource efficiency

Mr. D.J.S. Borkar (Public Works Department, Goa) talked about the water supply project for Panaji city and surrounding areas under JnNURM Phase 1. One project has been sanctioned but it is at tender stage. He gave an overview on the present water supply scenario stating that 92% of the water supply demand of the entire state is catered by 7 regional water supply schemes. He said that Goa state are working towards the vision for 2025 to (i) provide 24x7 sustainable water supply to all; (ii) ensuring that every household in the state disposes of its sewerage in environmentally secured manner and (iii) ensuring that every household has access to toilets.



Mr. L.H. Chawadi (Solapur Municipal Corporation, Maharashtra) gave an overview of the projects in water sector. He said out of three projects, one has been completed. The completion date for the rest of the projects is 2014.



Mr Bhavin Patel (Gujarat Urban Development Mission, Gujarat) said that the state of Gujarat has been doing quite well in terms of the execution of the projects. Out of 77 projects sanctioned, more than 50% have been completed in water sector. Also 88% of the total reforms have been achieved. The state of Gujarat has made decentralized planning of water and sanitation; rain water harvesting and reuse and recycle mandatory.

Dr. Rohilla concluded the session by saying that we are expanding the pipes but physical performance is missing. Thus we need to plan our DPRs towards sustainability.

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

Chair: Dr. 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 water/waste water system.

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 stated that there is an integral relationship between water and energy. And this relationship is based on the reality that treating water for human consumption and moving treated water to the consumer is an extremely energy intensive process. She mentioned that nearly 2 to 3% of the world's energy is used to pump and treat



water for urban residents and industry.

She stated that there exists enormous potential of improving resource/energy efficiency in water management as energy consumption in most water systems worldwide could be reduced by at least 25% through cost-effective efficiency actions. Dr. Pasi mentioned that in India energy costs account for 40% to 60% of the operating expense of supplying water, and that by becoming energy efficient, each Urban Local Body (ULB) can reap energy savings of 25% to 40% at a minimum.

She classified the approaches and practices towards sustainable and efficient water management as Preventive [Conservation of water (RWH); Promotion of water efficient fixtures; Water auditing and planning of water sensitive cities; and Preparation of CSPs and strategies]; Curative [Promotion of decentralized technologies; and Move from EM to natural systems (DEWATS, SBT, Phytotrid, etc)] and Reactive (Improving given system efficiency itself and Leakage reduction).

Pradeep Kumar (ASE, Bangalore) gave a lecture on Energy efficiency opportunities and challenges in water supply system



Mr. Kumar said that the Indian Municipal sector is the second largest in the world and consumes 4% of total electricity. He stated that there lies a huge inter-relationship between energy and water. For instance, 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.

He said that energy expenditure is the second largest cost after manpower. One-third of India's urban population lacks direct access to clean, affordable and reliable water

services. The present water supply is energy intensive. He mentioned that the cities are facing huge challenges with regard to energy efficiency due to lack of technical, managerial and financial capacity to design & implement projects; lack of metering & monitoring systems; connected load energy consumption doesn't match with the actual energy bills. He said that the key reasons for poor efficiency are over designing of pumps; changes in operating practices/schedules; efficient component not installed and/or operated properly and no existing government policy on reducing energy consumption in water delivery.

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 concluded his talk by giving an overview of the Goa water supply system. He stated that there are 7 major sources (*Opa, Assonora, Sanquelim, Salaulim, Canacona, Dabose and Chandel*) all of which are managed by Public Works Department. He said that the estimated energy saving potential at the rate of 25% is 34 Million Unit (for year 2013-14). He also highlighted the initiatives which the Goa government has taken towards water energy nexus by doing (a) Water & energy audit; (b) Water & energy conservation equipment and (d) NRW reduction program in place.

Prof. Somnath Sen (IIT-Kharagpur) gave a presentation on Water management to Water Sensitive Planning: A contemporary approach for sustainable urban development

Prof. Sen pointed out that the actual water crisis is not about having too little water to satisfy the needs but it's of managing water so badly that billions of people and the environment is suffering. He said that we have money banks and land banks but nothing of that sort for water.

He mentioned that according to the conventional water management technique the strategy of 'big pipes in - big pipes out' will not work in the present scenario.



Hence, there is an urgent need to manage urban development with minimal damage to water resources. He said that the need of the hour is to move towards a new approach for sustainable water/wastewater management which can be achieved by doing RWH, using storm water as a resource and reducing the runoff, reuse and recycle of waste water, and increased system efficiency at utility level.

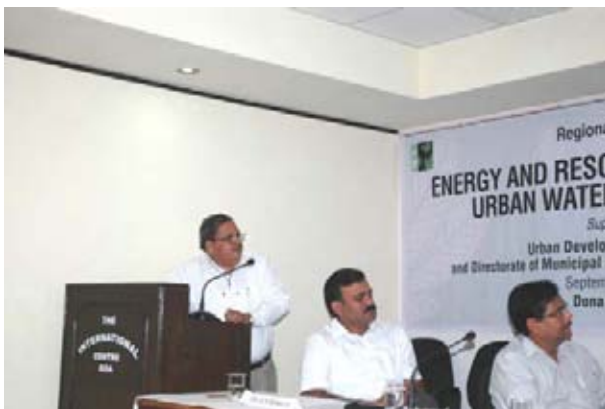
He emphasized the need to do research and find answers to (i) How Urban Development might be planned and executed in a manner so as to lower the hydrological impact of urbanization; (ii) To what extent rainwater available in an area could be effectively utilized with appropriate technology and environmental safeguard so as to partially meet the domestic water demand in local areas and (iii) What could be the appropriate technique for an effective flood control management in urban catchment under emergency situation.

He talked about water sensitive urban design by saying that it aims to minimize the impact of urbanization on the natural water cycle and its principles can be applied to the design of a single building or to a whole subdivision. If planned and implemented correctly, water sensitive urban design offers an opportunity for not only elements of the water cycle complementing the development, but the development to complement the water cycle. He said countries like Australia, Israel and USA have adopted the design. Water-sensitive urban design techniques include grassed or vegetated swales, filtration trenches, bio-retention systems, wetlands, rainwater tanks, grey water reuse, and porous pavements. In India, the technique has been implemented in Jamia Hamdard University, New Delhi, and IIM-Kozhikode.

He explained the water sensitive planning with the help of a case study done by his team in the city of Chennai. The aim of the study was to determine the feasibility of minimizing the adverse effects of urbanization on hydrological parameters through appropriate water sensitive planning, by integrating water supply, storm water and waste water management.

He concluded by saying that “Water Sensitive Urban Planning” is a relatively new approach that addresses a series of simple control measures such as land cover control, rainwater retention control, conveyance control of storm water through infiltration, and ultimately discharge controls through proper drainage systems for a sustainable catchment development right from residential cluster level.

Prof. Shyam R. Asolekar (IIT-Bombay) talked about Zero Liquid Discharge” Concept for Efficient Management of Urban Waters & Wastewaters



Prof. Asolekar gave an overview of the present water scenario in the developing countries. He said that there are imminent challenges in managing of water resources as disposal of untreated (or partially treated) sewage, sullage and industrial wastewater goes directly into natural watercourses. He said that we usually encounter the solution to treat the sewages and wastewaters to regulatory standards and then dispose them off into receiving bodies. The other less favoured solution is to treat the sewages and wastewaters to much high standards and then reuse / recycle them.

He said that there is an immediate need to upgrade the prevailing system because the installation and operating costs of existing technologies are rather high and hence are ill-afforded by the communities. The available technologies are often complex, require heavy machinery that are capital intensive as well as energy intensive during operation.

He stressed the need to treat wastewater as a resource and stressed upon the sensitivity towards local community needs as a key criterion for designing treatment options.. He stated that given the gap between wastewater generated and managed/treated in India, it will be a more favourable option to treat the wastewater and then reuse/recycle it for various purposes. He further noted that decentralized technologies/ systems would be most appropriate to achieve the goal of water recycling and reclamation. He discussed the approach by citing few case studies done by his team like constructed wetland research in IIT Bombay and success story of rejuvenation of Mansagar Lake, Jaipur.

Mr. Rajesh Pai (CDDS, Bangalore) delivered a lecture on Urban water management through Decentralised wastewater treatment

Mr. Pai stated that cities are likely to house 40% of India's population by 2030, which is nearly twice the population living in US today. **He said that as per the present scenario we need to take care of waste or else we will be in trouble.** He mentioned that according to the present urban water scenario in India about 70% of surface water is polluted and water demand will increase by 2.5 times in 2030 as compared to what was in 2008.

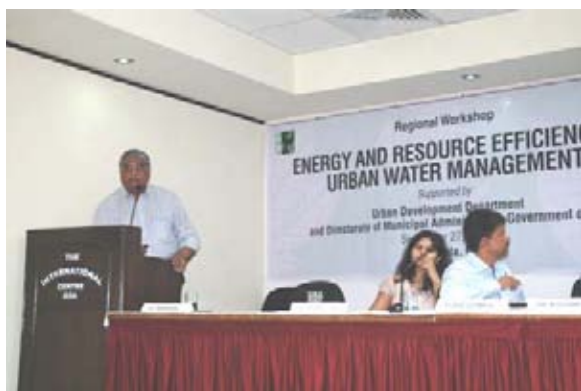


He said that in order to overcome the problem we need to know what will happen in next 5 years not plan things for 30 years. He noted that we need to take care of the waste water since we have exhausted surface water, contaminated groundwater and are not effectively capturing rain water. The need of the hour is to have an **efficient & effective; low-maintenance 'high impact' solution** which can be achieved by decentralized treatment methods. He further mentioned that the conventional systems offers solution at a very high cost, whereas the low cost solutions were ineffective. This gap, he claimed, can be effectively fulfilled by cost effective, low-maintenance, high impact solution provided by decentralized wastewater systems (DEWATS). He also noted that DEWATS systems can complement, not replace conventional systems in large city context.

PANEL SESSION on Mainstreaming Energy & Resource efficiency in sustainable urban water management

Chair: Elvis Gomes, Director, Municipal Administration, Government of Goa

Sandeep T. Nadkarni (Water Resources Department, Government of Goa) gave a lecture on Sustainable urban water management in Goa



Mr. Nadkarni talked about the importance of water with regard to sustainability of life. He said that the water resources can broadly be classified into two categories (i) the Surface Water Resource and (ii) the Ground Water Resource as both are dependent and interconnected as they are linked by the same Hydrological cycle.

He said that the developmental water resources scenario in Goa necessary needs to be blend of storage and run of the river schemes for optimal surface water utilization. He mentioned that till recently it was thought that water was inexhaustible. However, population explosion and industrialization

accompanied by urbanization has brought tremendous pressure on the water resources. Hence the need for a systematic water security/management is the need of the hour. He mentioned that the Municipal Corporations of Goa are working towards the development of storm drainage. However the issue to supply 135 lpcd of water for 24X7 is still under progress.

He concluded by saying that due to increase in urbanization there is a need to plan, develop, utilize and regulate the water resources in a optimal and eco-friendly manner involving a blend of traditional and technological innovative methods to preserve this precious resource for posterity. Out of box thinking and implementations have to be evolved for a best functional model.

Dr. A.G. Chachadi (Goa University) talked about Rainwater harvesting: Case study for Goa University

Dr. Chachadi said keeping in mind the water scenario of Goa, in 2007 he and his team came up with the detailed plan of 'Goa University rainwater harvesting and aquifer recharge project' in order to use the plentiful rainwater accumulating in the campus. The project not only recharges the ground water but also reduces the pressure on municipal bodies for water.

He said that the need for the RWH system was because the university largely depends on ground water, about 60% of the water supply comes from ground water and has been pumping for the past 25 years causing excessive drying of the pumps. In order to augment this groundwater, he carried out a lot of research like geo-physical studies, depth of aquifers etc. with the intention of direct recharge to the aquifer through deep borewell pipes as percolation was limited due to hard laterite soil.

He mentioned that the well yield tests carried out on two bore wells located in close proximity of the recharge structure during May 2008 (after one year of operation of the first recharge structure) have confirmed that there is an increase in the well yields by 13% to 15% which is considered to be quite encouraging.

He stated that due to the success of the system many local industries have adapted this system. (i) In 2011, system has been constructed in International Centre Goa with 25 lakh litres capacity. (ii) In 2008, Roof water harvesting and groundwater recharging at MES College, Zuarinagar; (iii) In 2010, Roof top rainwater harvesting and groundwater recharging at Birla Fiber Optics factory, Verna Industrial Estate, Goa; and (iv) Recharge estimation for a residential area in Porvorim plateau.



Dean D'Cruz (Moziac Desig, Goa) delivered a lecture on Effective use of water and energy in architecture and urban planning applications



Mr. D'Cruz discussed the energy water nexus. He said that it is important to reduce the **home energy consumption** as only 2.5% of fresh water is available on earth. He said that it is high time to move towards water efficiency approaches with regard to water consumption pattern in building; water-efficient landscaping and approach in designs. He said that now-a-days many building are constructed which are self sufficient in terms of captive power and water supply e.g. Pearl academy, Jaipur.

He said that now buildings are constructed to have **structural cooling** through green walls, facades & roofs. He stated that the aim is to construct building which are environmental friendly by having (i) terraces as they allow the day-light to enter the whole building; (ii) solar panels use to generate electricity; (iii) plants growing in boxes on terraces act as living wall bio-filters; (iv) industrial waste used as insulation between walls; and (v) recycled water used for flushing and irrigation.

He concluded by laying emphasis on the need to do RWH in a natural pool through roof runoff & paved surfaces. He said that we need to take steps toward sustainability by encouraging bio-diversity in urban areas and adopting to **water saving technology** like water fixtures, water-saving washing machines etc.

A.M. Wachasundar (Project Director, Japan International Cooperation Agency) talked about Sustainable water management: Goa initiatives

Mr. Wachasundar gave a background about Goa with regard to its population and water consumption. He said that according to the present water scenario of Goa, 92% water is supplied through the regional piped water supply schemes and balance 8% from spot sources. He talked about vision 2025 which is to have (i) optimum utilization of water infrastructure (ii) supply levels of 100 lpcd to rural areas and 150 lpcd to urban areas and (iii) provide 24x7 sustainable water supply to all.

He said that as part of its plan to start 24x7 water



supply in Goa by 2015, the government has drawn up an ambitious plan to reduce the state's non-revenue water (NRW) from a present 45% to 20% within a period of six years. Goa hopes to further reduce its NRW to 15% within the subsequent five years.

He mentioned that Goa state is in position to achieve the goal of 24x7 water supply through sustainable basis by creating awareness regarding the water supply service levels, judicious use of water and management of NRW levels. Thus within a span of 3 years Goa can become a model state in water supply sector with the support of all the stakeholders.

Dr. Mohan Girap (Goa State Pollution Control Board) delivered a lecture on Efficient Sustainable Urban Water Resources Management - Probable State-specific Initiatives



Dr. Girap laid the emphasis on Sanitation and Health & Hygiene and said that the factors affecting these are manifold and often inter-related. He said that the current paradigm is inefficient and unsustainable as more water supplied will lead to generation of more wastewater which will in turn increase the cost of treatment.

He said that one must attempt to facilitate better management and use of urban water resources by ensuring that appropriate level of consideration is given to the total water cycle at each stage of the planning system right from its **intake** up its **output**. He said that this can be achieved by opting any one

of the approaches (wherever practically feasible) (i) roof-top rainwater harvesting; (ii) recharging of borewells / environment-friendly construction of storm-water drains (i.e. unlined bottom); (iii) utilization of water-efficient fixtures; (iv) effective utilization of treated water for out-of-home applications and (v) decentralized wastewater management including its recycle and reuse.

He stated that there is a need for resource efficiency which is a key driver of success that promotes sustainable consumption and production, and contributes to achieving sustainable development. He said that it is essential to adapt to this approach in cities because over half of the population resides in cities with the urban population projected to be as high as 80% by 2050. The conditions for urban inhabitants, in terms of employment, environment, health, education and overall quality of life not only depend on how urbanization is planned but also how cities source, process and use resources. The indicators for water resource efficiency are (i) is drinking water distribution and water consumption in urban areas resource efficient and (ii) is urban water and sanitation operated with high energy efficacy.

He concluded by laying emphasis on the need for sustainable approach by moving towards efficient water energy fixtures, rain water harvesting, channelization of storm-water drains for optimum infiltration and rejuvenation and maintenance of lakes and ponds.

Ashwini Panandiker (TERI, Goa) gave a talk on Sectoral water demand in Goa

Miss Panandiker presented results from a research study on sectoral water demand that TERI did in the state of Goa. Sectors included domestic, tourism, mining, industrial and agriculture. It was found that there was a huge gap between demand and supply.

She said that in order to increase water-use efficiency of all the sectors following steps need to be taken up in the sectors mentioned (i) domestic & tourism (Use of water efficient fixtures; Improving service level benchmark and plugging of leakages and conservation); (ii) mining (reduction in mining and recycle and reuse of water); (iii) industries (regular water audits, fixing leakages; process change and water efficient measures and rainwater harvesting); (iv) agriculture (micro or drip irrigation and adoption of measures that increase the crop yield with less water).



The session concluded on the note that we all need to rethink, design and plan things in terms of sustainability and CSE has taken a good initiative to catch water where it falls.

PANEL SESSION on Mainstreaming Energy & Resource efficiency in sustainable wastewater treatment

Chair: S.T. Putttaraju, Town and Country Planning, Government of Goa

Roland Martins (Goa Civic & Consumer Action Network [GOACAN]) talked about need for consumer awareness & participation in energy and resource efficiency in urban water management



Mr. Martins said that while planning for urban infrastructure services the target population is completely left out. Unless consumer is taken into confidence everything will go in drain. He stated that the need to address the problem and find a long term solution is important but equally important is to maintain transparency and accountability in the issues. He said that many international companies are coming in Goa but it is important to keep the transparency in operation and cited the example of JICA in this regard. He also said that it is important to identify the target group as they will be different for different schemes.

He stated that we are celebrating **water conservation day** to **world toilet day** but what is the need if we don't spread awareness among the masses through programmes like these. He also mentioned that it is important to have tariff for tourist as the ownership is lacking in them and thus the local residents have to pay the brunt of tourists' misuse.

Dr. P.V. Pathak (Goa Energy Development Agency [GEDA]) gave a lecture on Solar water disinfection for millions

Dr Pathak talked about the use of low cost solar devices for water disinfection. He said that every year about 4.5 million people die due to water borne diseases. He said that the use of conventional technologies is expensive; requiring high maintenance and skill operation costs.

He stated that the laboratory and field tests have shown that **Solar Water Disinfection (SODIS)** is 99.9% effective against pathogenic micro-organisms found in water. This may not be as good as boiling which provides pathogen-free sterile water or even pasteurization. However, in terms of cost, affordability, simplicity and sustainability, SODIS scores over other methods. He said that throughout the pilot tested countries, a large portion (81%) of the samples gave a 99.9% disinfection rate.



He said that SODIS reduces the incidence of infectious diarrhoea, dysentery, and also protects against cholera. The sun's radiation is proven to be deadly to pathogens, which are used to living in the moist, humid, dark environment inside the body. Once they are discharged into the wider environment, these pathogens are extremely sensitive to conditions outside. UV radiation can be fatal to many such pathogens, while others are inactivated by maintaining a 50-57 degree C by heating in a bottle for a given period of time.

He said that SODIS works in a "35 degree latitude window," on either side of the equator that is, the region between 35 degree North latitude and 35 degree South latitude. The 35 degree window includes the complete continent of Africa, complete Indian subcontinent and almost all of the places in the world where children suffer from waterborne disease. He mentioned that this set up will cost about Rs 1200 for a family. It is equivalent to about one week salary of a casual laborer.

He concluded by saying that popularization of the set up will help to bring potable disinfected water within reach of millions belonging to the economically weaker sections of the society.

Pradip V. Sarmokadam (Digital & Environmental Solutions Pvt. Ltd.) delivered a presentation on Application of rootzone treatment system for waste water in automobile and sewage treatment



Mr. Sarmokadam discussed the use of phytoremediation as a set of technologies / methods based on various mechanisms associated with root-zone of different plants which leads to de-contamination, destruction, containment of pollutants.

He showed the efficiency of the technology by citing a case study. He said that before the installation of the technology there was some problem at the site, with the waste water from septic tank outlet and auto-wash water in combination giving a very bad odor. Although parameters of septic tank and automobile wash water combined like mainly COD, BOD, TDS & Suspended

Solids were on border lines of the specified limits but foul odour & oil and grease were to be addressed. Also quantities were more than existing capacity of treatment. Hence treatment system was needed. They proposed root zone treatment to improve quality of treated water before release and it worked successfully.

The advantages of the rootzone treatment include low consumption of electricity, reduced pollutant loads due to the activity of bacteria that thrive in the roots of the plants, aesthetics, low operational maintenance, lack of foul odor. The application is best recommended for septic tank outlet treatment; treatment of polluted streams/ nallas/ rivulets/ water-bodies (floating beds may be recommended); bathroom water recycling; and in combination with specific / simple pre-treatments the technology can be used as polishing treatment for any waste water.

D.J.S. Borkar (Public Works Department) talked about Sewerage scenario in the state of Goa

Mr. Borker gave an outline of the present sewage scenario of Goa. He said that Goa being tourist destination, it is essential to have an appropriate sewerage system for improving public health and quality of life. Presently sewer network exists in Panaji, Margao and Vasco Towns. He said that the PWD department is working towards the (i) 100 % coverage to be ensured wherever STPs are located; (ii) redesign of the existing sewer system network to ensure safe disposal; (iii) GIS Inventory Mapping & Data Base Management system; (iv) efficient maintenance mechanism; (v) establishing O&M system; and (vi) ensure 100% treatment of sewerage.



He said that as per the sewage facility first plant in India using SBR technology was installed in Goa in 2005. Presently this plant is covering part of Panaji City, with work under execution to cover entire Panaji City. He stated that due to the success of the project, many States have visited this plant and expressed satisfaction on the effluent. The effluent produced is good, with no smell, no gas formation and no environmental pollution. 25% of the water supply charges are billed to customer wherever sewerage facility is provided.

He stated that several sewage facilities have been proposed for Goa for Margao, Mapusa, and North Coastal Belt under JICA scheme, with the treated effluent water to be supplied to major industries. He also stated that as per the JnNURM, the sewerage projects will fulfill the norms such as 100 % coverage to be ensured not only for Panaji and surrounding areas; redesign of the existing sewer system network to ensure safe disposal; GIS inventory mapping & database management system; efficient maintenance mechanism along with establishing O&M system; and ensuring 100% treatment of sewerage.

Dr. Srikanth Mutnuri (BITS-Goa) talked about Recycling of wastewater resources for sustainable cities of the future



Dr. Mutnuri said that due to increase in urbanization and its ever increasing demands there is an increase threat to the natural resources which has a direct impact on soil which is losing its nutrients. Thus we need to move towards water efficient technologies for instance (i) dry sanitation / low cost solutions (ii) urine-diversion with flush sanitation and (iii) blackwater and integrated systems design.

He stated that poor soil can become highly fertile with clever management of biowaste and sanitation. He said that GIZ-ASEM under the thrust area “Sustainable Urban Environment” is currently supporting 6 municipal corporations (Shimla, Varanasi, Nashik, Raipur, Kochi and Tirupathi) under the JNNURM reform project. In addition GIZ-ASEM is also extending its technical support to promote sustainable urban sanitation solutions. Within the framework of the “International Climate Change Initiative” of the Federal Ministry of Environment, Nature Conservation and Nuclear Safety of Germany, GIZ-ASEM is demonstrating a waste to energy project.

He concluded by saying that for sustainability we must work towards a “Zero Waste”-Water Technology both at decentralized and centralized level.

Santosh V. Bhide (Detritus Solutions) talked about Decentralized Sewage treatment & recycle in urban areas

Mr. Bhide emphasized on the importance to have an efficient water resource system so that nothing gets wasted. He mentioned that there are two types of sewage management strategies (i) centralized and (ii) decentralized. He stated that the strategy and technology should fit to the local conditions which are environmental, economic, cultural and institutional. Also the strategy should be environmentally sound and affordable to the users.



While giving the current picture of sewage collection and sanitation in India, he said that Indian cities produce nearly 40,000 million liters of sewage per day, enough to irrigate 9 million hectares and barely 20% of this is treated. He also pointed out that much of the Indian population still depends upon groundwater sources for drinking, cooking and bathing which puts them at direct risk to the polluted water. He said that the lack of focus on water-sewage systems has led to a position where not a single city in the country has a sewage system that covers the entire population. Untreated sewage flowing into water bodies has almost doubled from around 12,000 MLD to 24,000 MLD in Class I and II towns.

He concluded by saying that centralized strategy proves efficient in pollution control areas and is the preferred strategy for planners; however it may not be feasible in some cases due to issues such as land, sewerage network, availability of funds, sustainable costs for the community served. Also the implementation period is longer. Hence; decentralized sewage management can be used to complement centralized sewage management projects as it is feasible; doesn't require large sewerage networks; can be implemented faster; on-site treatment ensures a direct check on the operation by users and user community gets benefitted directly.

Dr. Suneet V. Dabke (Concept Biotech, Gujarat) talked about Effective processing of Sewage Sludge and ETP Bio-sludge



Dr. Dabke said that as per CPCB norms the sewage generation for Class 1 and Class II cities is 35558 MLD & 2696 MLD, respectively. However, it is much more than the installed sewage treatment capacity which is just 11553 & 233 MLD, respectively, which is a concern.

He suggested that in order to overcome this problem the best solution to take care of non-hazardous waste by going for (i) composting; (ii) Vermicomposting for Bio-sludge and (iii) co-incineration of bio-sludge. He said that it is important to convert bio-sludge to non-toxic manure. However the treatment and disposal for such pollutants are very limited as disposal of inhibitory waste to landfills may

lead their leaching and dispersal in the environment, while the incineration would lead to their conversion to gases as pollutant.

He said that the introduction of vermitechnology in treating ETP sludge generated from the industry has a great advantage for bio-conversion of garbage, sewage sludge and agricultural waste. Promising result with use in bio-conversion process of ETP sludge of Pharma, textile, petrochemical, dairy industry etc. gives good result for treatment of effluent of agri-processing industry. The advantages of using vermitechnology are that it has increased efficiency in dewatering process of sludge drying bed; reduces sludge toxicity in terms of

heavy metals; increases nutrient value of converted sludge and reduces the volume.

The chair person concluded the session by saying that we had some excellent presentations on the issue of decentralized wastewater treatment systems and technologies; and there is a need to implement these alternative technologies/ methods for treating municipal waste. Now the question is how we propagate it?

Way Forward

It was mentioned that the need is to go beyond the discussion table and implement these alternate technologies. It was suggested that Directorate of Municipal Administration can take lead in this while CSE can provide technical hand-holding support and capacity building for relevant government officials.