



EU



**The Challenges of Mumbai as a Mega-city
- A way forward with the European Union**
First Working Group Meeting on environmental issues - Mumbai

July 10 and July 11, 2014.

Venue: Hotel Trident, Bandra-Kurla Complex, Mumbai

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Introduction

Mumbai and the metropolitan region around it has been growing seamlessly, with its total population expected to touch 44 million in 2052 even as the resources to service the burgeoning masses remain more or less stagnant.

In November last year, a joint exploratory conference between the European Union (EU) and Mumbai First with the full support of the Maharashtra government was held on 'The Challenges of Mumbai as a Mega-City - A way forward with the European Union'. The Mumbai conference had representatives from the government, planning and development authorities, private sector and EU's representatives as well as local and international experts. After some deliberations, it was decided to focus on three key development issues of environment, urban mobility and city planning through a series of separate workshops.

Taking forward that process, Mumbai First and the European Union (EU) hosted the first two-day intensive workshop on July 10-11, 2014, in Mumbai, addressing three environmental concerns – water management and disposal, solid waste management and renewable energy.

Over two days, experts from European countries such as The Netherlands, Belgium, Germany, Spain, Italy and Sweden offered insights into how they had tackled similar challenges in their cities. On the Indian side, principal secretary, water resources, Ms. Malini Shankar, Mumbai Metropolitan Region Development Authority (MMRDA) Commissioner, Mr. U P S Madan, Environment Secretary, Mr. R A Rajeev, Mumbai Transformation Support Unit (MTSU) Project Director Mr. B C Khatua and Former Chief Secretary of Maharashtra Mr. J K Banthia led the discussions of how European experiences could be applied to conditions here.

The workshop also enabled officials to have a one-on-one discussions with the EU experts on issues of their concern. The idea behind the interactions was to give Mumbai a leg-up in its journey along its aspirational growth trajectory.

July 10, 2014

Inaugural session

Chairman: Mr. J K Banthia, Former Chief Secretary, Government of Maharashtra

Opening remarks:

The workshop is designed to be a compact one to enable municipal corporation officials present here to discuss their specific issues with the EU experts here. Officials present here represent not only the Municipal Corporation of Greater Mumbai (MCGM) but also other corporations in the vicinity and outside the Mumbai Metropolitan Region (MMR) like Nashik, Aurangabad and Nagpur.

The conference is an opportunity to address some challenges we are facing, and the issues future urban explosion will bring such as drinking water shortages. These issues of urban management and the challenges on the technical, financial and administrative side will have to be addressed primarily by Mumbai Metropolitan Region Development Authority (MMRDA), the planning authority for MMR. Let us not assume that European cities are far too small for them to be relevant. It is up to us to scale up and customise the lessons learnt from them. But getting the latest and the best is the focus of the workshops organised by Mumbai First and the European Union delegation led by H. E. Dr João Cravinho.

Mr. Narinder Nayar, Chairman, Mumbai First

Welcome remarks:

It is an interactive workshop, not a conference, to build on the very successful conference with 35 experts that we had last year. The areas we should be looking at are environment, urban mobility and city planning. Environment is the first working group meeting with water, waste and energy being the key areas.

Water lies at the heart of the global economy. According to the UN, two-thirds of the world will face water stress by 2025. In 2009, there was a water crisis and there was talk of measures to remedy the situation. The then Chief Minister went to Singapore for a desalination study. It is said desalination is an expensive technology. But then, some countries like Singapore and Saudi Arabia have done it.

About 20 to 27 per cent water in the city is wasted in transmission and evaporation theft. We have 100-year-old pipelines, which can probably be regenerated with technologies available in Europe.

In solid waste management, 6-7,000 tonnes of waste is generated in the city every day. And it will grow immensely. We need ideas on how to handle it. The success of the closure of the Gorai Dumping Site is one of our triumphs and has been recognised in Barcelona. Its architect, Mr. R A Rajeev, is receiving an award there for his efforts as we talk.

To address these issues, officials from municipal corporations have been asked to come with specific projects for discussion with the experts present here.

H.E. Dr. João Cravinho, Ambassador of the European Union:

This is the first of a series of three sectoral events we have conceptualised to meet the challenges Mumbai faces where we believe the European Union (EU) has a lot to offer. For those who were not able to participate last year, here is a brief recap of how this process began. In February 2012, the president of European Commission, H.E. Jose Manuel Barroso, came to Mumbai and had wide-ranging discussions with Maharashtra Chief Minister Mr. Prithviraj Chavan.

One of the central themes that emerged was the difficulty in meeting the challenges faced by the city. It is a tremendously energetic city, transforming more rapidly than it has been possible to transform policies and governance. Mumbai and European cities face a commonality there though they are different in many respects and certainly different in scale.

The conference of November last year was an important first step in creating a partnership between the government and the EU on the challenges of urbanisation in Mumbai. Last year, we had 200 participants including Indian stakeholders, EU representatives, experts from private sector, governments. It is a tremendous pleasure for the EU to work with Government of Maharashtra and Mumbai First in finding the right platform to develop this process.

The 40-year concept plan for MMRDA predicts that by 2052, Mumbai would have a population of 44 million, including a workforce of 23 million, spread over 1,050 sq km. These facts require the planners to address issues like housing, infrastructure, enhancing competitiveness for the city, ensuring holistic lifestyle; in short, evolve a complex roadmap for dealing with interactive issues and challenges. European cities are different from Mumbai in scale and conditions but this is not an impediment from providing expertise and lessons learnt could be useful in the development of the MMR concept plan.

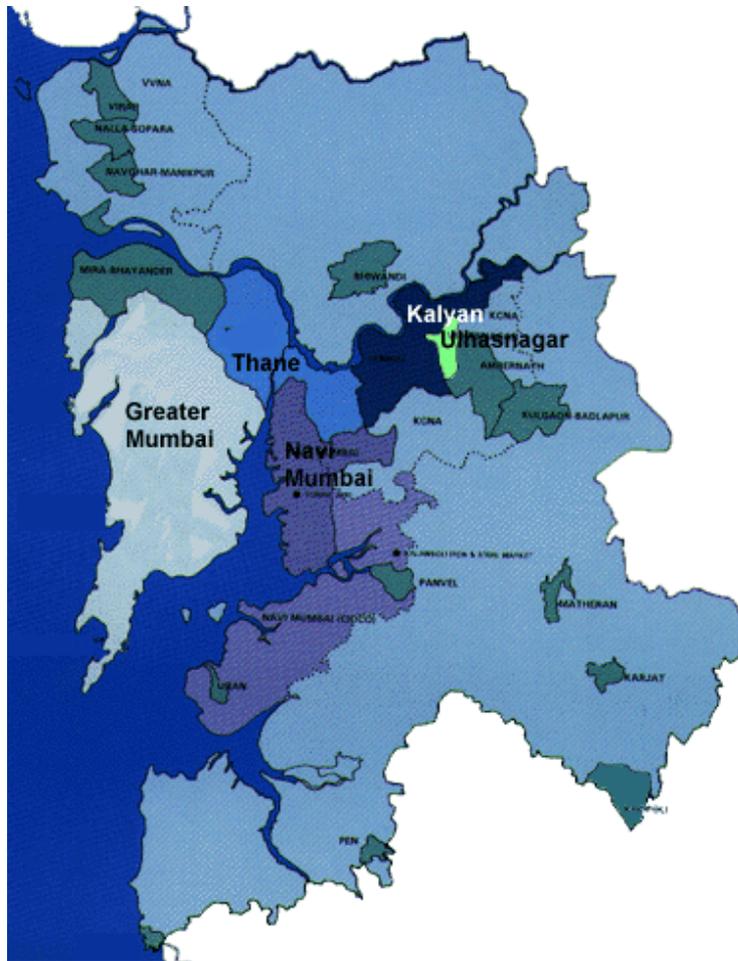
After last November's conference, we sat down and identified three areas – environment with focus on water and solid waste; energy and transport; and city planning in general for these workshops. In November 2014, we will have a workshop on energy and integrated public transport. In December, we will focus on urban and city planning. A lot of emphasis is placed on good governance without which all efforts would fail and in this field, the European experience could give some insights on finding solutions, maybe through financial mechanisms such as public-private partnership (PPP).

The problems that each of us face can best be addressed by the coming together of experiences. I am very pleased as Ambassador with the receptivity of the authorities in Mumbai to addressing some of these issues. This workshop is part of wider idea to develop a consensus that each of the problems cities face can best be addressed by coming together. The objective therefore is to channel the energies and experiences of European cities for a better understanding of the available solutions. I would underline our commitment and belief in forging a strong alliance with Mumbai.

Mr. U P S Madan, Commissioner of Mumbai Metropolitan Region Development Authority (MMRDA):

After a very successful conference last year, it is a great idea to have a workshop on specific subjects and in-depth sharing of experiences with those who plan policies in the European cities. Each one of us impacts the environment in some way or the other. Even when we breathe, travel, eat, consume – every activity has a direct or indirect impact on environment. So it becomes our duty and responsibility to do whatever we can do to reduce the impact of our activities in whichever way possible. There are many ways of doing that. We should make an effort to reduce the usage of water and energy. To my mind, wastewater depends on individuals more than local authorities. To the planning and implementing agencies, a lot needs to be done in these sectors.

In the MMR, we are struggling to meet the increasing demand for drinking water. Several studies have been done by MMRDA and several committees have given projections for the future requirement of water. Fortunately for us, it rains heavily in and around Mumbai. So there are water sources here but it is worthwhile to ponder how far we can keep adding to the supply resources.



Should we not look at demand side management instead? It is also important to check out other sources like recycling of waste water or desalination. Some efforts towards desalination and other technologies have been made in the past but these have not really moved forward.

Waste management is a huge challenge for all municipal bodies – we have not been able to find ways and means to manage waste. In most municipal areas in India, waste is dumped in a primitive way. Efforts have been made in some cities but there is no noticeable success. The best way to deal with waste is waste-to-energy which has been attempted in many cities abroad but in India, there is hardly any success story that can be showcased. Different technologies have been tried here but for some reason or the other, they have not worked well. We attempted to have a regional waste-to-energy

plant in which six municipal bodies participated but again, there were hurdles. Whichever technology we use, questions are asked about its relevance and likely success. The kind of garbage we have is difficult. But we do need to have some success stories. If we can get some leads from European cities in this respect, there is a huge potential to make it useful.

In energy conservation, a study, in which Mumbai First, National Environmental Engineering Research Institute (NEERI) and the US were partners, came up with some interesting statistics on what kind of electrical gadgets are energy guzzlers. Refrigerators emerged as the worst offenders, in absolute terms, because their number is so large. Almost every household has a refrigerator.

How do we reduce this consumption? Energy being a finite resource, we could borrow some more ideas from EU cities. European countries have helped us in many fields. The Netherlands have helped with reclamation, Belgium with infrastructure matters, Italy with quality control and Portugal in the cleaning of Mithi river in Mumbai. MMRDA will be happy to help to make the ideas generated here work.

Mr. B C Khatua, Project Director, Mumbai Transformation Support Unit:

Vote of thanks

All the four speakers have raised extremely valid issues. When I was the water secretary for Maharashtra, we worked hard towards 24x7 water supply but the political leadership developed cold feet. We also tried desalination but found it to be costly. In Chennai which has gone for desalination, the charges for water sourced from the ground were Rs. 30 for 1000 litres of water.

The MMR is blessed to get good rain. The gross per capita availability of water in Mumbai is 250 litres, which is very good. The quality of water too is good. However, when it travels from the treatment plant to the household, it gets contaminated along the way, thanks to the contaminants it encounters in old pipelines, through leakages, etc. It has been difficult to do spot replacement or repairs.

The most important issue in this sector is the billed quantity vs actual supply of water. Of the total supply of 4,000 million litres per day (mlpd), 30 % or about 1,200 million litres is unbilled. That is more than the total volume of water Chennai gets in a day. So, perhaps Mumbai does not require a new virgin source of supply if we tighten our belts and use water efficiently. Singapore is the best in this matter with only 5 % unbilled quantity while Seoul has brought down its unbilled quantity from 72 per cent to a mere 7% over a decade of forceful reforms. I do not see why we cannot scale down our losses as well.

In solid waste, it is important to learn how to segregate, reduce and manage it in a scientific and healthier manner. I hope this workshop throws up workable solutions.

Session I

Water Management: Conservation, Waste Water Recycling, Distribution and Ground Water

Part I: Safe drinking water, better water supply, waste water recycling, distribution and ground water.

Mumbai and the metropolitan region around it receives plentiful rainfall. Yet, it depends heavily on rainfall year after year. It is possible to conserve freshwater supply for future use but the region has not tapped, or even considered, the potential of conserving every drop of rainfall. Much of the rain outside the catchment area flows down to the sea.

Water is taken for granted and fussed over with stop-gap measures only when it is absent. Measures like rainwater harvesting have been made compulsory by some municipalities like Mumbai in the Mumbai Metropolitan Region but they are not followed seriously. The will to evolve and implement a long-term policy in consultation with national and international experts is missing.

Collection of data, the beginning of any serious exercise in attempting to understand and resolve an issue, is weak. There is a need to strengthen this aspect as also to bring all water-related agencies under one umbrella so that decisions are taken in a uniform and holistic manner. If we are to curtail the unbilled losses, water metering needs to be taken very seriously as meters map usage as well as seasonal differences in use. A place near Karad in Satara district in Maharashtra called Malkapur has achieved 100 per cent water metering with a telescopic rate system. The Kalyan-Dombivli Municipal Corporation, which started water metering, has received the prime minister's excellence in public administration award for 2009-2010.

A contract system that values low cost bids, lack of technical expertise in decision-making, lack of general awareness among the public and in government are some of the hurdles along the way. EU cities have some ideas to offer such as the urban tool box, step-by-step approach, conserving and re-using at home and office, tapping existing resources in an intelligent way by working with nature, ploughing back sewage into the ecosystems, etc.

In order to assist the government in making an informed choice, a technical advisory panel needs to be in place in an institutionalised form. The panel can aid the decision-making process by providing the necessary and sufficient research on the probable solutions.

The inability to engage with international experts outside the official hierarchy is a stumbling block in the free flow of ideas to foster a better understanding of sectoral issues. While it is crucial to have informed decision-makers, it is also important for implementing officials to get access to the information about and/or exposure to the workings of different systems for their effective implementation.

As the Dutch consul pointed out, it would be advisable to let foreign experts conduct studies or execute contracts, for a wider and clearer appreciation of the issue. The tendency to lean on Indian talent may not always yield the best results. Similarly, lowest cost should not be the benchmark for awarding consultancies and contracts for projects.

It is easier for municipalities to deal directly with EU agencies rather than expect the government to tie up as the government may have its own procedural framework to contend with. MMRDA has done that by entering into an agreement with a European contractor on a 50:50 sharing basis.

Mr. Radheshyam Mopalwar, Konkan Divisional Commissioner and Ex-member Secretary of Maharashtra Jal Pradhikaran (State unit managing water resources for Maharashtra):

In my five years in the water sector at the Maharashtra Pollution Control Board (MPCB) and Maharashtra Industrial Development Corporation (MIDC), I have developed some understanding of the water sector and would like to flag issues that bedevil us in the management of water. Issues of management of water have a geographical connotation. The Deccan Trap in Maharashtra makes up almost 82 per cent of the land in the state. This means there is almost no groundwater potential in Maharashtra, or it is highly limited and restricted by the nature of the underground aquifer system. So, we need to zero in on surface water availability and management becomes the focus. The western belt of the state, comprising the MMR and Konkan, sees 47 % precipitation. In other words, 53% precipitation goes to 90% of the geographical area.

The MMR serves a population of 20 million, which will grow exponentially. A redeeming feature here is the near-absence of agriculture. Generally speaking, the most competing demand of water in India is agriculture. In Europe however, it figures tenth on the list. We are fortunate that we have hardly any agriculture in the MMR. The rain-rich Konkan belt has eight lakh hectares (ha) of arable land per district of which four lakh ha is orchard which does not need much water. The balance four lakh ha is paddy fields which are not irrigated. So the greatest demand for water in the MMR comes from the resident population which is burgeoning. With Jawaharlal Nehru Port, Dighi port and new townships, there are 10 mega industrial cities in the area. All industrial areas from Tarapur to Talaja to Lote Parshuram are densely populated. The human population and industry are the two largest consumers of water.

The most important issue for us is the continuously increasing regulation of this sector. Coastal Regulation Zone (CRZ) became stringent in the last decade and then in 2011, we got the River Regulatory Zone. Fortunately, we actually get good quality water without any upstream pollution and without requiring much treatment, whether in Kalyan, Thane, Mumbai or Navi Mumbai. Minimal treatment is required to make it potable. There are no major water-borne diseases either, but pollution from discharge is becoming a serious concern.

Mumbai does not treat almost 60% waste water, and 50% population defecates in the open. When it comes to the urbanising and urbanised areas, the important issue is sanitation. The facilities for hazardous waste disposal and biomedical waste disposal in these parts are the best in the country but municipal solid waste is the most important issue to impact the quality of water.

We need a good database. We have misconceptions that we should get water at Rs. 5 per cubic metre whereas if treated waste water goes into recycling, it will cost Rs 12. It is possible to recycle waste water, especially as the Mumbai coast is getting greatly polluted by discharged and untreated waste water. The national policy states that out of every 100 litres of water, only 30% should be freshwater supply; 70 litres should be recycled water.

Nashik, Solapur, and Amravati are three examples of cities where waste water recycling is being done. In augmenting freshwater supply too, there are issues like land holding, tribal pockets, River Regulatory Zone, environment, development, etc. One of the points we need to debate is making people pay for water.

Ms. Malini Shankar, Principal Secretary, Water Resources and Irrigation:

In school, we were told matter cannot be created or destroyed. We were not told that water can be destroyed but not created. With a population exceeding 13 million, Mumbai has the challenge of providing water equitably to each citizen. Megacities in developing and developed countries are different. The GDP growth rate is higher than the population growth rate in developed countries. The opposite is true in developing countries. This means the exploding demand is not met by commensurate increase in supply.

Water is taken for granted and, like light, missed only in its absence. The Central government and state government do take steps to address this issue, whether on the infrastructure side such as drainage, sewerage, solid waste management, or on the non-infrastructure side, such as making every city develop benchmarks for drinking water and sewage to assess how the city is progressing on delivery of services.

In the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) programme, 74% of the funds for Maharashtra are allocated to the water sector including solid waste management, sewage systems, etc., i.e. Rs 9,000 crore out of Rs 12,000 crore. One shortfall of this programme is that it incentivised reforms for urban areas but did not offer a single incentive specific to the water sector.

The state government has taken excellent initiatives. Senior secretary Mr. Ajit Kumar Jain steered water sector reforms and set milestones to be achieved before any municipality had access to grants. These initiatives looked at benchmarks and actually handheld municipal corporations in various aspects like hydraulic modelling, efficiency of pumps, regularising connections. They allow cities to take what they needed for improvement in water services. Somehow, these got encouragement only from smaller municipalities and not the larger municipal corporations.

In Mumbai, 81% of the households are metered and 21% are unbilled. These figures need to be questioned seriously. The water issue is more than the quantum of infrastructure. The professional stakeholders are aware of the problem; what awes them is the magnitude. E.g. multiple sewage lines run above water supply lines, contrary to international norms, making the engineers wonder how to change this.

There are four possible areas of collaboration between municipal corporations and the European Union:

- **Data:** There are three large areas of non-revenue water – source to treatment plant, treatment plant to storage and storage to distribution. We need data on where exactly the loss is the highest. Otherwise, our focus is very ad hoc. Mumbai's availability of 250 litres per capita is one of the highest in the world for any megacity. London or Paris would get 100 to 110 litres of water per person. Though there is a provision in the water resources department to put in place a change management unit, its ownership has been rather nomadic. It was shuttled between different agencies. A change management unit needs to be set up in Mumbai itself.
- **Institutional arrangement:** The Municipal Corporation of Greater Mumbai (MCGM) has no department called water supply and sanitation. A separate department dealing with these fields needs to be carved out. Integration is required in water issues. Moreover, contracts should not be awarded on cost basis but on merit basis. It is time to look at

alternative forms of contract management that looks at performance attributes rather than cost attributes.

- Technology: for water treatment, recycling, desalination. The government does not possess the know-how to do a techno-feasibility evaluation of a technology that indicates which one will suit Mumbai in particular. Now, the government is looking at creating an independent panel that can guide corporations.
- Capacity building: Government engineers need to be citizen-centric. They should be aware of issues like segregation of waste, e.g. wet waste and dry waste vis-a-vis organic and non-organic waste. Recently, we undertook a 'water lab' across the state of Maharashtra, bringing together key decision makers from a few departments and making them look at issues. It achieved interaction and a keen look at integrated solutions. The EU can perhaps support institutions focussing on water, like Mitra in Nashik. There is no equal for Mumbai in the rest of the country. But some cities, similar to Mumbai, have gone a good job. In Dhaka, reforms have managed to reduce non-revenue water from 75% in 1980 to 53% in 2006. Chennai too has fared reasonably well in the reform area, and has good sewage treatment. Chennai replaced the entire infrastructure dating back to British days. If they could do it, perhaps so can we.

Mr. Soli Arceivala, Chairman of Environment Group of Mumbai First:

Mumbai is expected to grow from 12 million to 26.4 million in 2030. Almost 60% live in slums. We have 647 cars per km on the roads. Ideally, it should be 61 per km of roads. Future development has to be economically feasible, resource-efficient, environmentally sound and technically viable.

A single centralised agency needs to be set up with the undivided responsibility for solid waste for all of Mumbai from waste to disposal. In water supply, a 25-year resource plan with emphasis on water conservation and reuse is required. In sewerage, only 60% of the city is sewered and even less of this waste is treated. The way forward is to continue to increase sewerage systems and waste water treatment with World Bank or EU funding and expertise, use PPP to promote greater re-use of wastewater, provide fiscal incentives for individuals, get the municipal corporation to install local large-scale re-use plants. In Hyderabad, treated waste water is directly added to the lake since 20 years. In Jaipur, a lake has been created out of sewage but we cannot do that in Mumbai as the lakes are too far out and such an idea would call for a great deal of pumping. In Mumbai, we are asking people to treat and re-use individually. There are 20 places in Mumbai where this is being done.

Ms. Agostina Chiavola, Professor, Engineering Faculty of University of Rome "La Sapienza", Italy: Strategies adopted in the Province of Viterbo (Center Italy) to solve the problem of drinking water contaminated by Arsenic

We collaborate with public authorities and private companies to provide consultation on environmental problems. My expertise is in water management systems. Our approach is to start an overall process step by step that achieves the purpose of providing safe water with regard to environment. We start with collection and analysis of data and move towards designing a solution with the goal of optimising the water management system. This approach can be applied to each part of the water management system - collection, supply and treatment. It has been successfully used in many parts of Italy.

The methodology is a holistic modular approach for water management systems, design, implementation and improvement. Most problems faced in Italy and particularly in Rome, can be applied to Mumbai.

The four main steps involved are:

1. Preliminary assessment
2. Feasibility study
3. Project design
4. Design of the operations and control system

This approach was successfully applied to tackle drinking water contamination in Viterbo. In 2001, the Italian legislature established a new limit for maximum concentration of arsenic (As) in drinking water at 10 µg/l, down from 50 µg/l. Most sources were found to have a higher concentration of As and fluoride mainly due to natural sources which made it, thus, unavoidable.

The data was collected and analysed in a report. We studied how much drinking water was needed to replace contaminated sources, investigated the characteristics of the territory and the water distribution network, and explored alternative supply sources. Three possible alternative solutions were identified and a time schedule prepared for their implementation.

The population served was 3,25,000 to 4,37,000 inhabitants (average and peak). In all, 63 municipalities were found to have arsenic levels above the permissible limit. In the assessment, people were marked according to the concentration levels of arsenic. Among solutions available, full or partial supply from the lake was considered as the water quality from the lake was superior, but the option was discarded as the supply was not sufficient.

After considering other options, a combination of diffused treatment from contaminated sources as a short-term solution and, for long term, modifications to the distribution networks by reducing the number of treatment plants, mixing different sources, replacement of contaminated sources etc. were selected as the best solutions. Thereafter, personnel were trained in the efficient use of the systems. As the final step of this process, the operation and control system was designed in a way that it could handle different problems.

Mr. Lars Gunnarsson, Advisor for Water Industry, Sweden:

Urban water management – informed strategic decision-making

A Swedish Foundation-funded project researched the best plan for urban water management. It found a gap in the problem-solving exercise because decisions are not made by water experts but government. So, decision makers need to be well-informed.

When you have a number of conflicting choices, the decision on the right option has to be arrived at through a series of steps especially by bringing together aspects of sustainability like the ecological system, socio-economic system, technological and economical as well as and the socio-cultural system and the interstices of these factors. The fundamental question is often of improving the existing system or evolving a new one. Much of the problem is not a technical problem.

The urban water tool box talks of the way we work; it includes substance flow models: where do the chemicals end up, environmental and natural resources assessment, microbial, chemical and technical risk assessments –too often forgotten in the EIA, economic assessment, household aspects, organisational aspects and multi-criteria decision-making. The last aspect involves strategy, methodology and tools. By strategy, we do not mean actual plans but the ways in which we think to solve a problem and the values we hold. Stakeholders including decision-makers like politicians have to be informed and included to weigh alternatives.

Our working areas are sustainability in water management in new settlements, recycling and source control, energy savings, efficiency, and reduced emission of greenhouse gases, stormwater and wastewater management.

Sludge mixed with organic waste from the solid waste system can often be used at WWTP to improve biogas production. Sewage treatment plants in Sweden deliver more energy than they consume.

[Mr. Roelof Stuurman, Senior Expert, Groundwater, Underground and Water, Deltares, a not-for-profit consultancy, the Netherlands:](#)

Concepts for integral water management by integration of the natural water system and the water chain in an expanding city under changing climate conditions.

My house is below the sea level. I collect rainwater and re-use it. The best way to manage water is to start at home and office. We store it in the winter and use it in summer.

Demystifying groundwater is very important. One needs databases of all kinds to first understand what it is: water atlases, pilots, etc. You cannot manage what you do not know. We have used existing wetlands and raised them, and instead of using concrete, we work with nature.

An example is Nassau county, New York. Two years ago, the hurricane flooded the county. The damage done ran into billions of dollars. Out of 150 teams, 10 teams were selected which made presentations on how to make it safe. Our team designed solutions using existing wetlands but raising their level and using mangroves. We offered a concept of using models in the future that work with nature and not with concrete.

Mumbai has a lot of waste water and rainwater. There is no need for the city to use desalination; it can use the water there is.

The sequence for minimising flooding is retain, store and drain. A person should pay tax if water is passing through his or her house to the stormwater drain. At the end of the street, there should be an empty lot to store water. Drain only when it is really impossible. When we do that together, we solve the problem.

In New York, the groundwater level was down to three to five metres when they began treating waste water. They used infiltration and began recharging water in an inexpensive and green way. The problem is that the water is polluted. We are working on treating the water quality before it is infiltrated.

New Orleans loses 58% of potable water. In New Orleans, after Hurricane Katrina in 2005, the Dutch were invited to join Americans to design an urban water plan. Unlike other places, land subsidence (6-100mm/year) here was faster than sea level rise (3-10mm/year) because of the leaking wastewater, and stormwater treatment pipes. That enhanced the risk of flooding, damage to buildings and disruption of water management. It was tackled at three layers: land cover, infrastructure networks beneath and the soil and diversity underneath.

Solutions were devised at multiple levels – the lot (houses and gardens slow the flow), block (vacant lots store water), street (retrofits slow the flow), basin and region. In New Orleans, water was danger but they found a good solution and, we believe, water is fun.

In New Delhi, 300 years ago, water was distributed through gardens and interiors for cooling as in Red Fort. It was called Nahr-i-Bihisht or the 'Canal of Paradise.' But now, with a sinking water table, it floods a lot in the monsoon. Their solution was to use treated wastewater. It is necessary to use and reuse every drop of water, and use the subsurface. Nearly 80% of the discharge from Yamuna goes to the sea during the monsoons. Infiltration pumps can be used to tap the full availability of water.

The guiding principles should be conserve, store (re-use), discharge; create room for canals and rivers; land use follows soil type, elevation and ground water level; work with nature; re-use, re-cycle; include stakeholders.

Part II: Water management; waste water, sewerage, recycling, conservation

Mr. Michael Leischner: Head-Climate Protection Unit, City of Dortmund, Germany: Reconstruction of the River Emscher System in the coal mine area of Germany

With an area of 280 sq km and a population of 588,000 people, the City of Dortmund belongs to a conglomerate of cities in the Metropole Ruhr, which has a population of about six million. The northern region of the Metropole belongs to the River Emscher System, historically known as the coal mining area of Germany with many blast furnaces and steel factories.

Industrial exploitation of the coal mines began in 1920. The muddy areas of the River Emscher System had to be drained to extract coal and to protect the area from flooding. More than hundred years of first-class engineering converted the River Emscher System from a natural waterway system to a high-tech sewage system which worked very well for industrial purposes and for sewerage of private households but no longer had its natural character.

Since 1920, the River Emscher System gradually got converted into one of the largest open sewerage systems in the world. Being a natural disaster, most of the River Emscher System was a no-go area for citizens. The water level of the rivers could rise up to four metres in a very short time because of straightening and levelling of the riverbeds, compounded by heavy rains.



The decline of heavy industry in the region since 1990 threw up the opportunity to reconstruct the River Emscher System and restore it to a natural river system. That entailed sucking out sewage from the rivers and connecting the pipes to large sewage plants. With adequate space, the riverbed could be reconstructed in a natural way. The total cost for reconstructing the River Emscher System in the Metropole Ruhr is estimated at €4.4 billion and the tentative deadline is 2030.

In the city of Dortmund, one of the ideas proposed for reconstructing the River Emscher System was to integrate a lake in one of the former industrial areas. After a narrow vote margin in the city council, the current mayor told the urban planners to go ahead with the development planning. The contaminated soil of the lake area was brought to the planned business park area where it was completely enclosed in large sealed underground depots. With back to nature as the guiding philosophy, Lake Phönix became Dortmund's major attraction.

Mr. Michael Ohm, Architect and Civil Engineer, Urban Development Project Expert, University Bauhaus Weimar, Germany, representing Deutscher Städtetag - Association of German Cities:

Resource management in conurbations: Focus on the integration of self-sufficient TT ECOSAN systems

Thanks to my many years of experience in project planning and development in Asia, I hold this project especially relevant for the future of spatial, economic and ecological planning in conurbations of the Global South. Most conurbations (metropolises, towns, slums, etc. of the South) dispose of sewage in the rivers and seas or store them before the “front door”. With self-sufficient TT ECOSAN systems, it is possible to not only vastly reduce sewage but also produce from it raw materials like fertilizer, phosphor, drinking water and cycle them back in circulation. TT means Toilet Trennen in German, i.e. separate toilet.

On November 19, 2001, the World Toilet Organisation proposed World Toilet Day to be held every year on that day. On July 24, 2013, the general assembly of the United Nations unanimously proposed in Singapore that November 19 be observed by the world each year as World Toilet Day. Not more than 40 per cent of the world population has adequate and hygienic sanitary facilities. Impure water ends up causing a host of health as well as socio-economic problems, among other things.

Since 2001, the World Toilet Organisation also organises the World Toilet Summit. In 2006, this big event took place in Bangkok under the motto, ‘Happy Toilet, Healthy Life’. The World Toilet Day has to engage the people to remove the taboos associated with sanitation especially when good sanitation is still an issue for a large part of the humanity.

National governments should dedicate at least three percent of their budget to sanitary care and water supply, and to fight the corruption in the water sector. The benefits are many: good tourism, cleaner city and healthier citizens.

Conventional central sewage disposal methods like watering canalisation are widespread in industrial states. Multi-stage sewage treatment plants require high investments and high water consumption - which would further aggravate the water situation, apart from running huge capital costs and operating expenses. As such, they are not a viable solution for many countries, e.g. arid developing countries. Also, for ecological reasons, they have come under increasing criticism, because sewage sludge fertilization (which also contains treacly metals and environmental chemicals) poses new environmental problems. On the other hand, the health hazards of conventional (aerobic) sewage treatment and the chemicals cannot be eliminated.

Here is where ECOSAN comes in. ECOSAN (derived from Ecological Sanitation) are ecological systems for sewage management and sanitary care. The introduction of these systems means a paradigm change in the settlement water economy: Faeces and domestic sewage are looked upon as valuable materials, which can be taken back into the ecosystems for use. These systems involve a logical conversion of a material stream and circular flow economy oriented to mass flow. They offer promising alternatives to conventional systems of sewage disposal.

ECOSAN systems allow an entire or partial return of faeces, urine and greywater (sullage) which contain nutrients with the greatest possible re-use, for example, to the agricultural irrigation. An often advantageous material stream separation and concentration can be reached, for example, by uric dissolution or the separation by black water and greywater. In the end, the application of suitable

systems such as TT ECOSAN, as well as the application of compost toilets and sewage plants, is beneficial in every way and narrows the scope of health risks.

ECOSAN TT has minimal power demand for waste and sewage treatment and uses the energy potential contained in the firm and liquid rubbish (e.g., as a fermentation gas). In that sense, it is ideal for sustainable development. This understanding is recognised among experts extensively and is already demonstrated in numerous projects.

We would like to analyse here, with the help of my research in the context of an already developed technology (TT-ECOSAN), the economic considerations and the integration of such systems in space, city concepts, as, for example, in Mumbai and indicate possibilities of an improved ecological and economic balance.

Session II

Renewable Energy and Energy Efficiency for Green Buildings

Mumbai tops the green building movement in India, which is second only to the US in green building footprint. Like water, conventional energy is a finite resource. In a climate with steadily depleting fossil fuels and the resultant pollution from conventional energy plants, it is important to revisit the way energy is viewed. Renewable energy sources like solar, wind, and water are not just easier on the environment, they also do not carry the risk of depletion. Continuous improvements and upgrade of technology have made it possible to generate energy at home, on surfaces or on hilltops.

While availability of energy in the Mumbai Metropolitan Region (MMR) is more or less stable, it faces the pressure of a highly dense and rapidly growing population. Mumbai, which has had a smooth run in terms of its electricity generation and supply, may need to soon look at unconventional ways of generating energy to offset the growing demand. Maharashtra has an agency entrusted with developing alternative energy sources. The Maharashtra Energy Development Agency is a government body which works for the promotion of non-conventional and renewable energy sources. However, it does not receive the required political and administrative thrust to meet its mission objectives. As a result, there are isolated and scattered events in solar energy such as those in Ulhasnagar and Nashik. A concerted drive could give it the momentum it needs.

A worrying trend in Mumbai is the popularity of glass facades in building design. While they work in colder cities by blocking the cold air and letting in the sun, they are inefficient in Mumbai's tropical climate where sunlight is plentiful. In fact, it achieves the reverse by blocking sunlight and trapping the heat in, pushing up the building's air-conditioning costs.

Here, Dortmund offers an inspiring model for building energy-sufficient green buildings which can actually sell surplus energy produced at home. It is possible to fuse related departments under one umbrella to facilitate smoother planning and implementation, as Barcelona did to reinvent itself as a smart city. Vitoria Gasteiz has a greening approach to energy saving, with creative measures like plants on outer walls of homes to reduce the air-conditioning load and foresting large pockets inside the city. Reducing energy consumption and stipulating energy efficiency performance standards for buildings, as Belgian cities have done, are other ways of addressing issues in this sector.

None of the ideas borrowed from EU cities can be replicated in Mumbai as they are, given the metropolis's complex dynamics and cosmopolitan fabric, apart from its scale and size. But it may be possible to devise a customised algorithm for the city and the surrounding region based on the learnings culled from the varied experiences of European cities and develop its agenda for zero emissions and carbon neutrality.

Mr. Michael Leischner: Head-Climate Protection Unit, City of Dortmund, Germany:

Energy efficiency projects of the Integrated Action Programme for Climate Protection in the City of Dortmund

In 2011, Dortmund designed a Programme of Action 2020 to Mitigate Climate Change. The objective was to reduce 40% carbon dioxide by 2020 as compared with 1990. The implementation strategy included 96 projects resting on three pillars of climate change and energy turnaround - renewable energy which includes wind, sun, geothermal, energy and biomass; energy efficiency which includes

focus on EnergyPlus buildings, production processes and energy heat/cold coupling; and energy saving which includes sufficiency, building refurbishment and standards for new buildings.

One of the 96 projects to be highlighted was the campaign to build 100 EnergyPlus buildings in Dortmund. These buildings produce more energy than needed. This means there are no energy costs for the residents. On the contrary, they can earn money from the sale of surplus energy.

A hundred housing units are to be built in EnergyPlus standard from 2011 to 2016. A hundred plots in seven new housing areas on the basis of development plans have been identified for such buildings. Investors too got interested in the plan because such a house was not too expensive compared to a conventional house. The plots were sold out within a short period.

The houses are about 137 sqm each, have underfloor heating, no cellar, efficient air-to-air heat/cooling recovery, solar supported heat pump yielding a surplus of 1.600 kWh/a produced by photovoltaics on rooftops.

Geothermal energy efficiency systems are already in operation in more than 1,000 buildings in the city of Dortmund. It works through a system that brings water in a pipe from underground wells to the surface and into a heat exchanger which concentrates the energy and releases it inside the house as heat. In hot summers, the process is reversed.

Even skyscrapers can be built in a sustainable way. An eight-storeyed wooden house has been built in passive house standard (which stands for quality and energy efficiency) in Bad Aibling Germany.

[Ms. Carme Gual Via, International Relations Coordinator, Urban Habitat, Barcelona:](#)

Barcelona: towards a self-sufficient city

Barcelona is a compact and cohesive city. Converting it into a smart city took vision, expertise and meticulous planning that converged urban planning, ecology and information technology. Among the principles of a smart city are: defining the city's mantra and action plans based on its structure. Barcelona's mantra was to become a city of productive neighbourhoods, interconnected, eco-efficient, re-naturalised and self-sufficient in energy with regeneration at zero emissions. As a smart city, it aspires to be efficient, sustainable, productive, social and free.

The Olympics of 1992 was the starting point for the transformation of Barcelona. In 2012-2013, it got ranked as the 10th smart city on the planet, 4th smart city in Europe and first smart city in Spain. Its 22 programmes included smart lighting - which is not expensive due to sensors for colour, temperature levels, uniformity, and contrast. Other programmes included smart water, energy efficiency, zero emissions mobility through electric vehicle for individual as well as public transport and provision of 249 recharging places for a population of 1.6 million, zero government, smart regulation, intelligent urban furniture and smart innovation.

The energy efficiency programme included complete energy autonomy in buildings, raising awareness among the people about producing and consuming their own energy.

As a Mediterranean city, Barcelona gets periods of drought. We reduced consumption and it stabilised because of popular participation. It is very important to count in and count on the people. With its all-round initiatives, Barcelona has become a world reference for smart cities.

Mr. Javier Maroto Aranzabal, Mayor of Vitoria-Gasteiz:

Vitoria Gasteiz as the European Green Capital 2012 and sustainable building with an example of energy refurbishment: the Europa Congress Centre

Vitoria is the capital of the Basque country on the north part of Spain with a population of 242,673 on a surface area of 277 km, with a density of 101.5 people per hectare. It's a city where everything is at hand on foot or on a bicycle. Stockholm (2010), Nante (2013) and Copenhagen (2014) are the other winners of the European Green Capital Award in different years. Vitoria Gasteiz was the first medium-sized city to become the European Green Capital in 2012.

Eighty per cent of Europe lives in medium-sized cities. So what happens in these cities can be replicated elsewhere. We start with the fundamental belief that “The city is not a problem but a solution because the city has the answer to everything” as Jaime Lerner, former mayor of Curitiba (Brazil) said. The city of Vitoria Gasteiz is surrounded by a green belt. It developed many green practices to transform the city into an inner green belt by creating little forests in the middle of the city. One-third of the municipality, i.e. 11,000 ha is forested. Everyone in this city lives within 300 metres of a green space.



Refurbishing 20,000 houses would mean energy savings of 36.2 million kWh. Plants growing on the outer wall of the house protect the walls from the Sun, which reduces the air-conditioning load in summer and heating in winter. Refurbishing of the Europa Congress Centre is a case in point. It has received several energy certifications including LEED Gold. Other similarly sustainable public buildings include the Ariznavarra Day Care Centre for the Elderly, Ibaiondo civic centre, New Central bus station, and New Town Hall offices.

Ms. Katleen Govaerts, Unit Manager, ‘Transitions, Energy and Environment’, VITO NV (Flemish Institute of Technological Research), Belgium:

Energy and buildings and the policy of Belgian cities

The EU-27 environment is responsible for 40 % of energy consumption and 36% of greenhouse gases. We have the challenge to reduce carbon dioxide levels by 80% by 2050. The main reduction in the following decades is to be made in the transport and construction sectors. In the transition towards

clean, secure and competitive energy system, we need to reduce energy demand and integrate renewables.

By 2050, 75% of the global population will live in cities, i.e. 75% of resource consumption on 3% of the surface. In other words, it will increase the density of urban areas. Dense urban areas are less carbon-intensive than areas with low density.

The EU has set a target of a 20% CO₂ reduction by 2020 by improving energy efficiency and using renewable energy sources. Through the initiative of the European Commission, the Covenant of Mayors - a movement of European local and regional authorities - was formed. It has over 5,000 signatories from small villages to metropolitan cities.

The movement forward is to be made step by step:

1. Analyse the energy use and carbon footprint of the city.
2. Have a common vision.
3. Define qualitative and quantitative pathways and see which quick wins you can take.
4. Communicate with, motivate and empower stakeholders.
5. Set up experiments and monitor progress.

A study says in the next 30 years, \$350 trillion will be invested in global urban infrastructure. An extra 6%, i.e. \$22 trillion, is needed for zero-carbon infrastructure, which could lead to savings of \$55 trillion. A net saving of \$33 trillion in carbon savings is thus possible.

Leuven is a small city which spends €250 million a year on energy. Tweewaters is a carbon-neutral district in Leuven which is into cogeneration, energy storage, smart appliances, district heating, and a climate action plan, among other things.

Reducing consumption to 60 % is necessary to move towards a climate positive condition. It is important to remember that sustainability is more than climate positive. Once energy consumption in a home is optimised through measures like cogeneration, insulation, and air density, the choice of material and energy-related aspects is equally important. These factors could lead to up to 52 % savings.

Cities can lead by putting in place strategic energy policies. Energy efficiency performance standards for new buildings are a first step. Rebuilding the existing building stock, drafting building or district ratings, creating awareness about green materials, and subsidy programmes for green buildings can follow.

[Mr. Joel Fernandes, Regional Director, European Business and Technology Centre \(EBTC\)- Western Region, Mumbai:](#)

EBTC experience with green buildings

There are 2,635 registered green buildings till July 2014 in India, of which 507 are certified as such. With 2 billion sq feet of green building footprint, it is second only to the US. However, there is scope for scaling up to 10 billion sq ft of sustained building footprint by 2022.

Mumbai tops the green building movement in the country, partly because of shortage of resources such as water and energy. The Indian LEED rating system, the Indian Green Building Council and The Energy and Resources Institute are the key drivers in this area.

Some barriers in the movement for green buildings are lack of awareness, lack of incentives by municipal corporations such as FSI (floor space index- the area that can be built upon in a project), no performance evaluation tools to measure and verify the gains of green building, limited availability of local raw material and equipment. It is a myth that green buildings cost more than conventional buildings. Green buildings cost only 2% more.

In Europe, the European Commission has shown the way. It has collected examples of 'Green Public Procurement' in a brochure to inspire public and private procurers to opt for green products. It took four decades of sustainable policy-making for Germany to become Europe's green leader. Some of the lessons we could learn from its growth are: start small and expand pilot projects gradually in scope or in scale, encourage citizen participation and communicate.

Eight parameters went into developing the European Green City index: carbon dioxide, energy, buildings, transport, water, waste and land use, air quality, environmental governance. Overall, Copenhagen scores the highest on these criteria. Its municipality has created two flagship programmes to create carbon-neutral neighbourhoods in partnership with stakeholders like energy companies, architects and construction companies.

Among other European cities, Berlin uses 556.9 Mega Joules (MJ) of energy per sq m (as against the index average of 909 MJ). In 2010, London offered low-cost energy-efficient equipment such as low-wattage bulbs free of cost for retrofitting homes. A €1 billion Czech programme for retrofitting buildings in Prague is financed from the sale of CO₂ permits to Japan.

Budapest is retrofitting buildings to cut emissions. In one of the large projects, the building was fitted with solar cells; it received new insulation layers and windows with a target of 50% reduction in the building's energy consumption.

July 11, 2014.

For a city that's bursting at its seams, it is a feat to achieve the closure of a dumping ground instead of adding one more. The scientific closure of the Gorai Dumping Site in Mumbai is one of the city's trophies in infrastructure management. When it comes to solid waste, Mumbai and its neighbourhoods have improved their collection methods but continue to score poorly on the processing of waste. Sporadic efforts at vermiculture and composting are under way but those are largely confined to individual initiatives rather than a community programme.

The Mumbai Metropolitan Region (MMR) has not yet applied its mind seriously to the management of solid waste. On paper, it has fault-proof Supreme Court guidelines but there is little in terms of implementation on the ground. Open dumping - and burning of waste in pockets - has wrecked its environment. Rampant burning at the ground has polluted the creek waters abutting the city and affected its air quality.

The session brought out the relevance of setting targets, incentivising processing and dis-incentivising generation of waste as well as non-compliant management by the imposition of taxes and fines. It busted the myth that solid waste management pays for itself.

Some experiences such as that of Sweden depict incineration to work well especially as it converts waste into energy although there is the risk of building excess capacity but Mumbai is still far from that point. The experience in Flanders discourages incineration. A user tax for waste collection and disposal is another way to curtail waste generation. It is also important not to have too many levels of responsibility or decision making.

Field visit to Gorai Dumping Site to take stock of its landfill closure

Mumbai generates around 6,500 tonnes of solid waste every day. About 2,000 tonnes of this volume from the western suburbs was sent to the Gorai dumping site every day till December 31, 2007. Spread over 19.6 hectares near the Gorai creek and close to habitation, the Gorai dumping ground was operational from 1972.

On collecting and hoarding its maximum capacity of about 2.34 million tonnes of waste up to an average height of 26 metres, its scientific closure was recommended by Infrastructure Leasing & Financial Services as per the Municipal Solid Waste (Management & Handling) Rules 2000.

As part of the closure, the ground was to be levelled and the heap of waste was to be reformed with the help of environmental mitigation measures. The closure was achieved at the cost of Rs503 million by covering and compacting with construction and demolition (C&D) waste and layering over with a liner system. A landfill gas recovery system has been installed at the site in order to capture methane emissions in the future. To incinerate these landfill gases, an enclosed flare system has been provided. According to the Municipal Corporation of Greater Mumbai (MCGM), this is considered to be the most reliable and environmentally safe process for incinerating landfill gases. Apart from a flare burner, a chimney with a stack height of 12 metres has been installed.

MCGM has received an advance of Rs250 million against future delivery of carbon credits from the Asia Carbon Fund of the Asian Development Bank (ADB) for the Gorai project. The transaction is

one of the largest carbon advance transactions in Clean Development Mechanism (CDM) in the world.

The scientific landfill closure and methane capture project at Gorai, completed in July 2009, sets a benchmark in urban rejuvenation. The closure of the Gorai Dumping Site has benefitted Mumbai in many ways: the unusually cramped city has got an additional 19.6 ha of open green space; its ambient air has cleaned up; the quality of creek water has improved as has marine life; and a rejuvenation of mangroves is visible. The closure has eliminated problems such as foul odour, fire, health hazards, breeding of flies and rodents, and led to an overall improvement in public health and hygiene.

The project has been nominated as one of the top ten Public-Private Partnership (PPP) projects in the East Asia, Pacific and the South Asian region by the International Finance Corporation.

The EU delegation, along with government and municipal representatives, NGOs and Mumbai First, made a site visit to the Gorai site on July 11, 2014 and came back impressed.

Session I

Solid Waste Management

Mr. Ajit Kumar Jain, State Information Commissioner for Greater Mumbai:

Solid waste management is the basic responsibility of the urban local bodies (ULB). It is regrettable that our concept of solid waste management is confined to collection in a rudimentary way through the activity of sweeping. That explains the unhygienic conditions in which collection is still done.

The Surat plague epidemic of 1994 was the turning point in India vis-à-vis solid waste. A few things happened at that time. The Government of India set up a team to legislate Municipal Solid Waste Management Rules. Secondly, a public interest petition was filed by an activist, Almitra Patel, in the Supreme Court against open dumping of waste in 1996. The Supreme Court set up a committee for drafting the rules which came into existence in 2000 providing a legal framework for a gamut of activities such as generation, storage, collection, transportations, processing and disposal into a sanitary landfill, etc. Then came the Supreme Court committee recommendations which are very detailed. It went into all aspects - welfare activities, human resources, involving NGOs and so on.

Thereafter, the Government of India, the Central Pollution Control Board, state governments, state pollution control boards, citizens' groups and others took the initiative in capacity building. I was a member on nearly all these groups. A technical advisory group was set up by the Government of India which gave a detailed report discussing not only processing and disposal but also various technology options for collection systems and suitable cost-effective solutions as well as identifying technology providers and vendors. So a lot of homework has already been done. Last year, when a study group was suggested by someone, I had pointed out that this area has been studied the maximum but what is required is to implement it.

There are many reasons we lag in taking this sector forward.

- Financial constraint is the primary reason these recommendations do not see the light of day. One wrong impression governs the thinking in this area: that solid waste management pays for itself. The idea was that if you compost your waste and sell it to the farmers, that will take care of your entire expenditure of waste processing. Urban local bodies, therefore, did not bother to make budgetary provisions for solid waste management and started looking at this activity as a source of revenue. Not surprisingly, few came forward for this work when tenders were floated as the criterion was not the lowest cost but maximum royalty. Compost, it was found, is not easily saleable. Its transport cost is higher than the cost of processing. There has to be willingness to make allocations for SWM.
- The NIMBY (Not In My Backyard) syndrome: The first dump site closed was in Malad where a mall now stands. Then came Gorai. The emphasis was on closures perhaps because we cannot manage our sites, sparking local opposition to landfill. At the same time, there have been some improvements: vehicles for collection have improved, sweeping activity has improved considerably.
- Let's not focus only on Mumbai. India has 5-6,000 cities. Maharashtra alone has 250 urban local bodies. Hardly ten per cent of these are large cities, which mean we need decentralised solutions as land is a problem. A decentralised approach with a common landfill site for smaller towns would work.

Mr. Soli Arceivala, Chairman, Environment Group, Mumbai First:

The way forward is to set up a single corporate agency within MCGM, like BEST for transport and electricity in the island city areas of Mumbai, with undivided responsibility for solid waste management of all of Mumbai from source to disposal. Besides solid, there is medical, e-waste and food waste. EU can be very helpful in this regard.

Ms. Jenny Aström, Project Manager, Export, Avfall Sverige - Swedish Association of Waste Management, Sweden:

Swedish experiences on food waste recycling

As a company representing many municipalities and companies in Sweden, we have solved many problems by working together as one nation. The bulk of Sweden household waste goes into incineration with energy recovery. A very tiny amount goes to landfill. We use waste as a resource, and do not see it as a problem. About 30% is sorted and recycled, 20% is food waste that we separate and make biogas and biofertiliser out of it. This is becoming increasingly popular in Sweden.

Almost half of the waste is incinerated and used as energy in heating houses and electricity. It has not been easy and has taken long. We have made some mistakes but we have been successful. Mumbai can do it much faster as it is already so engaged. You have solutions; you just have to start rolling.

From 1975 to 2012, Sweden's waste management has moved from 62% landfill to just 1% while steadily augmenting its energy recovery through incineration. In the nineties, it was decided that we wanted to use all the waste as a resource. It does not pay by itself. So we decided to develop a policy that pushes waste away from landfill.

A mix of instruments was used: a landfill tax was introduced in 2000, landfill of combustible and organic waste was banned in 2005 and a national target for food waste recycling set in 2010. Disincentives such as energy tax with increasing rates in the 1970s and carbon dioxide tax in the nineties, on the one hand, and incentives such as tax reduction on biofuels for transport (2004) and investment subsidies and grants, on the other, made the movement towards clean reprocessing easier.

Water and sewage can be integrated in efficient solutions. Food waste recycling could be a good starting point for Mumbai. The reason is that it meets all the five steps of the European waste hierarchy: reduce, reuse, recycle, energy recovery and landfill (if you cannot do anything else). Food waste recycling reduces the amount of waste going to the landfill; most importantly the food that creates methane gas which is toxic from a climate perspective. Households which recycle enhance environment awareness and contribute to total waste reduction.

Sixty per cent of the municipalities in Sweden collect food waste separately and recycle. We are one of the world leaders in food waste chain from collecting to producing biogas and biofertilisers. Most of the biogas is used as car fuel. During 2012, 353 GWh of vehicle fuel was produced from waste replacing 30 million litres of petrol. Nearly all of digestate, which is produced in bulk, is used in agriculture as bio-fertiliser.

Different collection systems were tried and it was found no one method was superior to the other. Each was as good as the other. Much more important is good planning, good organisation and motivated personnel, and clear, defined goals. Getting good quality waste is very important. India has been collaborating with Sweden on waste-to-energy (WtE)/biogas since 2009 on a project to make biogas fuel for buses in Delhi, solid waste management in Vizag including food waste processing in a 15-year perspective, a biofuel centre in Bangalore, and an India Sweden Innovations accelerator last year to adapt innovations in Indian circumstances.

Mr. Christof Delatter, Head - Waste Management Policy Department, Association of Flemish Cities and Municipalities, Belgium

Success factors of the Flemish policy on household waste management

Belgium is a federal state. Dutch-speaking Flanders has 6,381,859 inhabitants against Mumbai's 12 million, and a density of 466 inhabitants per sq km as against Mumbai's 20,700 inhabitants per sq km. But we consider Flanders highly industrialised by European standards. The port of Antwerp has the second largest concentration of chemical industries in the world after Houston, Texas. We also have very intensive agriculture as well. So, traditionally, there is high pressure on land use in Flanders, like in Mumbai, with little place to dump waste.

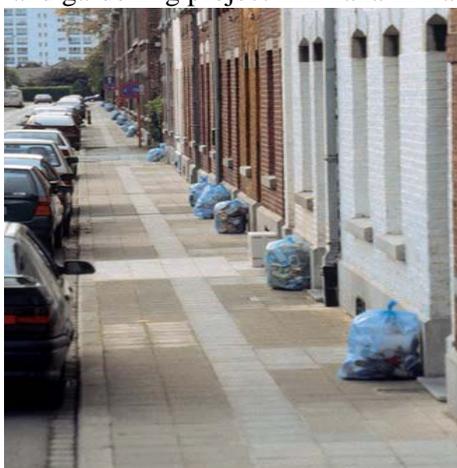
In Flanders, there are two levels of government involved. The EU, if you can call it the third level, sets directives. The Flemish government sets the general policy objectives, fixes the minimum services to be organised and approves the Flemish waste management plans. Since 200 years, the 308 municipalities have been responsible for implementation - collection, recycling and treatment of waste as well as fixing waste taxes. As an individual, a citizen cannot enter into a contract with any agency. He has to deal with the municipality for his waste.

Till 40-50 years ago, open dumping was the norm in Flanders. In the eighties, most of the 2,394 dumping sites that were discovered were closed because of their proximity to habitation, forcing the local authorities to find another solution for household waste.

Most municipalities did not have the financial means to invest in waste landfill sites. Regional taxes too had to be paid on waste. So we found a solution by creating an alternative political and financial capacity through an inter-municipal corporation which takes care of the waste of 250,000 inhabitants. Separate corporations owned and controlled by municipalities were formed in this manner. Political representatives from the municipalities made up their board. So, no separate level of governance was created and that is very important.

Over the years, we set up a waste management policy based on the policy decided at the level of Flemish government. In 1991, the Flemish government looked at the local situation, gathered the experiences of municipal organisations and began with an inventory of the situation with the idea of moving away from landfilling. We started with separation of waste collection. In 1997, a new waste management plan put emphasis on the prevention of waste and prohibition on landfilling of solid waste. People were helped in taking care of waste.

Almost 50% of population today has home composting. We are involved in a rooftop composting and gardening project in Dhaka in Bangladesh.



Household waste management was financed through municipal taxes. A pay-as-you-throw system was also evolved from 1997 and waste was billed depending on weight. A particular type of bag is used to put waste in. The money collected from the billing was used to recycle waste.

From 2008, there was consolidation of collection, composting and recycling. The year also saw the first shift from waste management to sustainable consumption. There is no point building too much waste incineration capacity when the primary target is to reduce waste. Excess incineration capacity can also pose a problem. Incineration is necessary only for

waste you cannot compost or prevent.

Municipalities have high remediation costs for non-compliant dumpsites and taxes on incineration. Like in Sweden, we have taxes on landfilling and on incineration. Again, like Sweden, Flemish waste management plan bans landfilling for certain types of waste and taxes them. Extended producer responsibility for packaging waste has been introduced. The cost of sorting and recycling packaging waste is integrated into the price of a disposable product such as a plastic drinking water bottle or a battery. This leads to huge cash flows, that is used to set up recycling infrastructure. This is one of the low hanging fruits that India could use.

Municipalities can use a mix of instruments:

- Legal: enforcement of fines and the obligation to sort waste
- Social: community awareness, schools, waste calendars
- Financial: pay-as-you-throw, support prevention, dumping fines

The results of these strategies were a very strong system of doorstep collection, and a high rate of recycling. A huge gain was that since 2002, waste quantity has stopped growing. In 1991, 18% of the household waste was collected separately. In 2012, 71% of household waste was collected separately for recycling (not energy recovery) or composting. Construction waste was also part of it. We regranulate clear rubble and use it in public works.

Residual waste has come down to 149 kg per inhabitant per year in 2012 from 331 in 1991. Half the collection is done by private and half by government. Both have their pros and cons. The private sector is more visible in recycling because they have a stronger link with production companies. The use of public-private partnership depends on local circumstances and is not a goal, or part of legislation in Flanders.

The learning from these experiences is: not to have too many levels of government. We have just two - central level making the basic strategy decisions, and the local level making the local ones.

Economy is not the main driver and technology is the least important factor in solving the waste problem. Rather, policy is. The cost in Flanders is €80 per inhabitant per year and only 10% of this is financed by revenues from waste. It took us more than 20 years to get this kind of result.

We are working with two cities in India - Shimla and Coimbatore - on small scale initiatives for better household management.

Mr Ajit Kumar Jain:

These presentations emphasise it is important to reduce waste upfront rather than have an end-of-tunnel approach. Somehow, we have not been able to reach a tipping point where we make it the order of the day. Fiscal tools as incentives are necessary. The key issue is to decentralise sustainable solid waste. Our Supreme Court guidelines do talk of the 3Rs. The problem is in implementation probably due to institutional, fiscal or enforcement issues. Suryapet in Andhra Pradesh state is India's first waste-complaint city. It has achieved zero garbage and shown us it is possible.

Session II

Conclusion and Summing up with Way Forward

Mr. R A Rajeev, Principal Secretary, Environment Department, Maharashtra:

Special address

Last year, Thane got €1 million grant from the EU for urban energy efficiency and renewal programmes. From the presentations, it appears Sweden and Belgium have reached where we want to go even if they were not always on the same wavelength. Sweden gets extra garbage from Norway and treats it because it has spare capacity. Every city has a different environment and is unique. It needs to reinvent its specific wheel. The increase in urban population creates different problems.

In solid and liquid waste, our local bodies are not performing to our own standards. For some emissions like dioxins, India does not have any standards. Not a single release of treated waste water from all state treatment plants meets the Central Pollution Control Board standards. We end up polluting the seawater which is as harmful as dumping waste.

The state environment department does not have teeth that bite. The national laws do not have them either. Barring two to three municipal corporations, nobody is processing more than 50-60% of solid waste, and no more than three to four municipal corporations are partially treating their liquid waste.

Why is this happening? Archaic laws such as the one prohibiting municipal corporations from giving land on nominal leases makes the Maharashtra government thwart any solutions that municipalities come up with. That single clause has been instrumental in getting some projects stalled.

There is a lot to do in this field. Data shows that those cities or countries doing maximum source segregation of solid waste are cities with maximum incineration facility. Incineration happens after landfilling. Wherever capacities for incineration or waste processing have been created, source segregation happens to the maximum because the waste processing method itself requires incentives for segregation. International data bears out that a waste processing facility is followed by segregation as a byproduct and makes it sustainable.

The need of the hour is to create capacity to process waste as the setting up of processing plants renders sustainable management irreversible. All urban local bodies should work towards this and the state government must create the right environment for it.

There are two ways to do it:

1. At the technical level, let municipal corporations invest in such plants if they can afford. If they cannot, the state government can provide grants or loans. Once a plant is ready, its operation and maintenance can be handed over to professional agencies.
2. Urban local bodies (ULBs) today are not able to deal with solid and liquid waste because the organisational set-up in ULBs has not developed to foster leadership although they have good engineers. Every time, a ULB wishes to do something, they engage outside experts. In Singapore, 100% waste is being incinerated. It is one of the cleanest cities in the world. It works with fifth generation incinerators and its own staff manages up to fourth generation incinerators. The city has invested in its human capital, by sending their engineers to Germany and other countries to learn the systems. We could learn from them.

PPP is not well received here because politicians do not understand it well. In fact, political leaders are not involved in this area but they should. Mayors, for example, can do advocacy. Apart from Gujarat and Kerala which are very good at tourism, no chief minister makes statements to keep their state beaches clean. These are mundane issues of administration but very important all the same. We lack the culture of leadership. Our politicians or corporates do not talk of a no-litter campaign.

The role of the private sector is important too. The 'Keep America beautiful' campaign that started in 1953 was almost completely a corporate affair. It is one of the largest non-profit movements, with no-litter campaign being a part of it. ULBs, private sector, politicians and citizens' groups have to work in synergy to make it a priority area and see to it that these basic issues are addressed. The urban habitat department in Barcelona includes environment, urban planning, clearances, and gardening. To plan any project, all officials handling these areas sit together and make a blueprint after which it is given for implementation.

Seoul constructed flyovers in the beginning and broke them to rejuvenate the river. In Barcelona, they demolished flyovers to make public spaces. In Mumbai, we are still constructing flyovers. That does not mean we should stop doing that. Likewise, it also does not mean we should stop processing waste by technologies we are advised against using. Whatever technology is available, we must process it. Belgium has closed landfill sites in thousands whereas we have managed to close just one or two in Mumbai.

[Mr. Jayant K Banthia, Former Chief Secretary, Maharashtra:](#)

The way forward

It has been a high-calibre conference. Key speakers from the EU, representatives from the Government of Maharashtra, particularly the Jawaharlal Nehru Urban Renewal Mission (JNNURM) and environment department, and various municipal bodies have participated and engaged in the process of taking the Mumbai Metropolitan Region (MMR) forward. At the next conference to be held later this year, we can consider inviting the political executive and involving them in this process as well.

Rural local bodies have thrown up fabulous leadership in Maharashtra which has worked out very well for agriculture, cooperative sector and animal husbandry in Maharashtra but the political representation from urban local bodies is poor. For years, the Chief Minister has been handling the urban development portfolio among his other duties when, ideally, it should be under the exclusive charge of an independent minister. The larger municipal corporations need to throw up leadership that is much more sensitive to areas of urban governance.

Some takeaways from the two-day conference:

- Ensuring a panel of global consultants which is acceptable to the government and to the ULBs. It would facilitate the study of ideas.
- Getting the European Union to engage with municipalities directly so that studies can be started at the earliest.
- Swedish and Flemish presentations have shown government responsibility in creating a policy framework is absolutely essential.
- Prime Minister Narendra Modi has already talked about having smart cities in India. MMRDA has suggested five programmes to work towards this idea.
- The Vitoria presentation showed greening the periphery of urban centres is not the only goal but it's as important to keep the internal areas of a city green as well.

- It is an excellent idea to explore solar energy to the maximum. We could consider how incentives can be put up in building regulations, both in green field and brown field projects, to promote solar energy.
- ‘Water is fun’ has become the catchword. Working with EU experts in developing the waterfront could be very useful.
- It is extremely important for the MMR region to reconstruct waterways. While we have a huge plan for the rejuvenation of the holy Ganges, I am thinking of the vanishing rivers in MMR areas which face challenges like land grabbing. Rejuvenation of the nallahs is also very important. They are an eyesore and have turned into a dump. As chief secretary, one of the challenges we faced was to get a perennial source of water for Mithi river.
- I request on behalf of Mumbai First that the government takes up inter-departmental coordination seriously. The Prime Minister, in his inaugural speech, has said that in 2019, India should be talking of sanitation. He has given ‘Swachh Bharat’ topmost priority and has suggested it as a way to celebrate Mahatma Gandhi’s birthday. This is a challenge for urban India including the MMR. While we are trying to ensure these issues are addressed for urban areas, I would urge Mr. Rajeev to see what could be done in rural areas for sanitation as well, some of which are as big as Flemish municipalities.
- Mumbai First will revisit the idea of converting Mumbai into a clean city and find out if corporates can be made more visible. That the corporate sector has shown interest in the past is encouraging.

To take it further,

- The email addresses and phone number of EU experts have been circulated to all participants. Mumbai First would facilitate this interaction.
- Mumbai First could catalyse some initiatives. For instance, it may help Kalyan-Dombivli Municipal Corporation in taking forward its desire to provide 24x7 water supply. Similarly, we could take up some wards for improvement if not the entire city as a whole.

In all, it has been an extremely exciting and interesting workshop. The participation of everyone has been tremendous.

[Ms. Karine Olislagers, Cooperation Manager, Delegation of the European Union to India](#)

Concluding remarks

The last two days have been intense and instructive. As Ambassador Cravinho mentioned, we are looking to achieve a better understanding of the current challenges that Mumbai has to overcome. Technologies and financial solutions can be further discussed. The event is in the right direction and all need to work together to maintain the momentum.

The aim is to share the experiences at the country level, and at the city level. It is up to you to decide what you need. It is not just an issue of technology. We have to have follow-ups to ensure the leads from this workshop are crystallised into something relevant. The creation of one success story is necessary for replication. Building on nature may be a way forward. One of the potential areas of cooperation identified by Water Resources secretary for Maharashtra, Ms. Malini Shankar, is data collection and analysis. This is the key for firming up water management.

EU models and methodology could also be applied to Mumbai. Concepts such as urban water tool box existing in Sweden would be useful. Institutional arrangements as in alternative systems of contract

management need to be worked upon. From Barcelona, we learnt how it is the city and not the company which should decide the technology.

Decisions need to be taken on improving existing systems or developing alternative ones. We could also come in in the realm of capacity building. The EU experience in influencing demand and supply of water, pricing, enhancing energy efficiency in the easiest and least expensive way could be of use.

In all cases, the involvement of stakeholders is a must. Each citizen can make a difference whether in demand and use of water, segregation of waste or energy consumption or even using bicycle and contributing to urban planning. In energy, possible actions to improve efficiencies in the easiest and less costly ways can be explored.

Solutions work at multiple scales - we could continue the discussions, initiated yesterday, on a one-on-one basis. Next year, a large general conference is planned similar to the one we had in November last year. At that conference, we would like to announce concrete projects and actions between EU cities and Mumbai.

As Ambassador Cravinho said we need to find a modus operandi through a concrete programme of actions. A smaller workshop on energy and integrated public transport and another one on urban planning are expected soon.

I would ask Mumbai First, government and other agencies to let us know where, in these areas, EU practices and experiences could add value. I thank all my European Union colleagues. I am confident our collaboration will intensify even more in the coming months. The workshop has given us a better understanding of the challenges and as we are working in the right direction, we need to follow up and build on the momentum.

[Mr. Narinder Nayar, Chairman, Mumbai First](#)

Vote of thanks

It has been a wonderful workshop. All the three subjects are very important for the city. We are very encouraged and excited about the idea of panel of global consultants and capacity building. We need to develop these and we will take it forward.

I thank all the bureaucrats who took out the time and made the effort to make a valuable contribution to the event. I also thank Ambassador Cravinho and all the EU experts for sharing their experiences and adding value.

Interactions among participants at the workshop

The workshop addressed many areas of concern and interest for the urban local bodies (ULBs) in Maharashtra. Senior officials from various municipal corporations such as Mumbai, Kalyan-Dombivli, Nagpur and Nashik, MMRDA, Jawaharlal Nehru National Urban Renewal Mission (JNNURM), Government of Maharashtra, National Environment Engineering Research Institute (NEERI) and NGOs like Nagar raised specific queries on subjects related to their field of interest with the EU experts.

An official associated with sewerage projects in the Municipal Corporation of Greater Mumbai (MCGM) was looking to learn about technologies for seven waste water treatment facilities which were to be built. An executive engineer with the Mumbai civic body wanted to know if it was possible to completely avoid the human touch in sewerage and waste water collection, conveyance and

management. A Kalyan-Dombivli corporation official asked about avenues for sale of treated waste water and whether it could pay for itself.

The wide range of interest areas that emerged around the axis of presentations made by the EU experts included the latest technologies in sewerage treatment and solid waste management, the success of solid waste management on a regional scale and meeting the e-waste challenge in the MMR, green building norms, river pollution management plan in the state of Maharashtra, water conservation programmes, preparing cities in Maharashtra for climate change, designing sewage pumping stations and sustainable technologies for reducing the BOD discharge from effluents to under 10 mg per litre, as recommended by the high court.

In connection with the proposal to provide Mumbai with 24x7 water supply, the important aspects identified by an official were customer surveys, utility mapping, hydraulic modelling, equitable distribution, quality assurance, asset management, and water supply in slums.

A key concern raised at the conference was the change in technology each time a new officer took charge of municipal departments. The feeling that all decisions are contractor-driven in the MMR resonated with others as well. It was suggested that authorities should consider engaging people from outside the country wherever necessary for better comparisons.

MMR officials mooted the formation of an institution to assist the bureaucrats in the selection of the suitable technology in all sectors. For this purpose, a technology advisory panel to do the risk assessment of a technology was also suggested. Environment secretary Ms Malini Shankar spoke about the need for a technology-neutral contract as it would leave room for the adoption of the best technology.

A municipal official spoke in favour of letting third party experts conduct pre-feasibility studies and doing the scratch work for a project to eliminate the possibility of exaggerated projections, among other things.

Summary of Findings and Recommendations:

The workshop on environment issues offered insights into how European cities and towns have handled urban issues revolving around the three areas of water, energy and solid waste management. Following the presentations of European Union (EU) experts and subsequent discussions, representatives of the urban local bodies of the Mumbai Metropolitan Region (MMR) are looking to consolidate the process with fruitful initiatives.

It was well appreciated by EU experts, MMR officials, and other participants at the workshop that Mumbai's size, density and diversity of population could render a simple replication of methods from EU cities difficult. At the same time, the experiences of EU cities, especially the technologies, the problem-solving approaches, and the innovative solutions, could give Mumbai a head start and confidence in the direction it wished to go, in addition to offering exposure to global thinking and practices.

Some of the gainful learnings from the two-day meet:

Policy-wise,

- EU experts could be involved in four areas: data collection, integration in sectoral management, technology and capacity building.
- Expertise could be institutionalised by way of a technical advisory panel to assist urban local bodies in decision-making. Wherever decisions are made by non-experts, it is important to ensure they are well-informed.
- Involving foreign consultants in feasibility studies and/or execution of contracts is relevant to gain from their experience and expertise.
- It is easier for municipalities to deal directly with EU agencies as MMRDA has done.
- The model of Public-Private Partnership (PPP) could be explored to enhance quality and add value to the functioning of utilities.
- Technology or economics are not the primary consideration in any solution. The means have to justify the end.
- Public motivation is one of the biggest drivers for sustainable growth. Communication, public awareness campaigns and an approach encouraging citizen involvement in a common vision could bring results.
- Fewer levels of authority and decision-making foster streamlined governance and generate quicker yields.
- Setting varied term targets for every goal on the environmental landscape and taking a step-by-step approach is the way to go. Along the way, qualitative and quantitative pathways should be defined and quick wins should be identified.

Solution-wise,

- As options such as desalination are unviable for Mumbai, the city should look inward at a mix of instruments, including involving every home in the answer. Storing every drop of water that falls into buildings with the possible provision of an empty lot at the end of the street and draining only when necessary, could be the means to conservation. Wastewater recycling, as is currently being done in smaller cities like Nashik, Solapur and Amravati, needs to be pursued vigorously in the MMR.

- Quantum leaps are required in the MMR's treatment of the solid waste sector. It has to shrug off its uni-dimensional approach to solid waste management as a collection and dumping crisis. For reduction and segregation of waste, EU cities have demonstrated simple technological solutions.
- Fiscal incentives for water conservation; for reducing and recycling solid waste; for treating and recycling wastewater; and for energy conservation and efficiency have been shown to be highly effective and should be included in any long-term programme for mitigation of environmental stress.
- Multi-stage sewage treatment plants call for a high investment and are not a viable solution for developing countries. Environment-friendly technologies, or ECOSAN systems, not only vastly reduce sewage but also produce from it raw materials like fertilizer, phosphor, drinking water and cycle them back in circulation by using the energy stored in liquid and solid waste.
- The River Emscher System has striking similarities with the Mithi river restoration in Mumbai. If it was possible to reconstruct the River Emscher System in the Metropole Ruhr and restore it to a natural river system, it is possible to clean and restore Mithi to its pristine self and find a perennial source of water for it.
- Dortmund has demonstrated how energy-sufficient green buildings can sell surplus energy produced in-house. Geothermal energy efficiency systems based on underground storage should be tried on a pilot basis in the MMR.
- The innovative approach used in Vitoria Gasteiz of greening the outer walls of houses to curtail air-conditioning demand is an easy and cost-effective way to save energy in a high-consumption city like Mumbai with its tropical climate.
- Barcelona has shown smart lighting to be inexpensive.
- Bicycles do not work well for Mumbai's long and linear distances. But these could be encouraged as the onward commuting option for a citizen's short journey from a rail or metro station to his/her home/office.
- Landfill should take the last place in any solid waste management system. Building waste incineration capacity is important but excess capacity creates its own problems. While Sweden favours incineration with energy recovery, the Flemish emphasis is on recycling and reuse. Sweden's determined shrinkage of landfilled waste to 1% is worthy of emulation, especially its focus on food waste recycling.
- Waste does not pay for itself. The MMR should reorient its thinking in favour of long-term and indirect returns in the form of improved quality of environment and sustainable growth of the region.

Note: MMR comprises eight municipal corporations –Mumbai, Thane, Navi Mumbai, Kalyan-Dombivli, Ulhasnagar, Bhiwandi-Nizampur, Mira Bhayandar and Vasai-Virar, 9 municipal councils – Ambarnath, Panvel, Kulgaon-Badlapur, Khopoli, Pen, Uran, Alibag, Matheran and Karjat, and 982 villages. It has a population of 20.7 million, of which 12.4 million live in Mumbai city. Mumbai city covers merely 10.7 % of the MMR area. There are 40 planning authorities in the region, with 1,273 sq km of urban area of which Greater Mumbai covers 468 sq km and the other corporations and councils cover 805 sq km. The rural areas of MMR cover 2,614 sq km.

List of participants – Indian

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2.	Mr.	Ajit Kumar Jain	State Information Commissioner for Greater Mumbai	
3.	Mr.	Hrishikesh javkar	Video Recording	
4.	Ms.	Seema Kamdar	Note Taker	
5.	Mr.	Y C Anil	Project Manager	Fairfest Magazine, Urban News Digest
6.	Mr.	B N Patil	Director Environment	Government of Maharashtra
7.	Mr.	J K Banthia	Former Chief Secretary	Government of Maharashtra
8.	Mr.	J S Saharia	Chief Secretary	Government of Maharashtra
9.	Ms.	Malini Shankar	Principal Secretary, Water Resources (CAD)	Government of Maharashtra
10.	Mr.	R A Rajeev	Principal Secretary Environment	Government of Maharashtra
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