Trip Report
Climate and Clean Air Coalition (CCAC) MSW Initiative
City exchange visit to Delhi, May 1st – 4th, 2017

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Contents

**Trip Report** ............................................................................................................................................. 1

Introduction and background .............................................................................................................................. 3

List of participants ............................................................................................................................................. 4

1\textsuperscript{st} May 2017 ........................................................................................................................................ 5

Visit to the Ghazipur Landfill site, the 12 MW RDF Plant, and LFG recovery facility ..................................... 5

Tour of the 12 MW RDF Plant at Ghazipur ....................................................................................................... 5

Tour of the Ghazipur landfill site and landfill gas recovery (LFG) facility ....................................................... 6

Visit to the Gulmeher Livelihood Centre .......................................................................................................... 7

Tour of the Construction and Demolition (C&D) Site at Shastri Park ............................................................. 7

2\textsuperscript{nd} May 2017 ....................................................................................................................................... 8

Visit to Okhla 500 TPD Compost Facility and the Timarpur-Okhla 16 MW Plant ........................................... 8

Tour of the Okhla 500 TPD Composting Facility ............................................................................................ 8

Tour of the Timarpur-Okhla 16 MW WtE plant ................................................................................................. 9

3\textsuperscript{rd} May 2017 ......................................................................................................................................... 9

Observation of collection and transportation services – Rohini Zone .............................................................. 10

Visit and tour of the integrated waste management facility at Narela-Bawana ............................................. 11

4\textsuperscript{th} May 2017 ....................................................................................................................................... 12

Day of discussions at The Energy and Resources Institute (TERI) ................................................................. 12

Discussion on India’s National Municipal Solid Waste Management Handling Rules 2016 ....................... 12

Presentation on the role of the informal sector and NGOs involved .................................................................. 13

Annex – Agenda ............................................................................................................................................... 16
Introduction and background

The Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants (CCAC) is a voluntary global partnership of governments, intergovernmental organizations, businesses, scientific institutions and civil society committed to catalyzing concrete, substantial action to reduce SLCPs (including methane, black carbon and many hydrofluorocarbons). The Municipal Solid Waste Initiative, one of the eleven initiatives in the Coalition, supports cities and national governments to develop sustainable municipal solid waste management policies and practices that achieve key development priorities – such as improved public health, service provision and job creation – and lead to near-term climate benefits.

It is known that cities are some of the most important partners in addressing methane and black carbon from landfills and other waste management activities. As a lead partner of the CCAC Waste Initiative, the International Solid Waste Association (ISWA) together with the C40 Cities Climate Leadership Group and in partnership with the City of Delhi conducted a four day workshop inviting city officials from Johannesburg, South Africa, Quezon City, Philippines, and Rio de Janeiro, Brazil, to visit New Delhi, India, and learn from the waste management practices there.

Delhi generates over 8,000 tons of waste per day, and similar to Johannesburg it has to deal with high organic content and high moisture in its waste stream. Delhi has had experiences in developing several successful public-private partnerships to manage waste through composting, landfill sites, effective waste collection and fleet management (using GPS), and developing alternative waste treatment facilities. Thus, Delhi offers many lessons for Johannesburg, and the other invited cities, to ensure a suitable and sustainable integrated solid waste management system. In 2012 the Municipal Corporation of Delhi was ‘trifurcated’, i.e. split into three smaller municipal corporations. The new North Delhi Municipal Corporation and South Delhi Municipal Corporation each contain 104 municipal wards, the smaller East Delhi Municipal Corporation contains 64 wards.

The purpose of the visit was to facilitate knowledge exchange amongst the participants to support the ongoing solid waste activities and identify crucial interventions for their respective cities. It covered a range of topics as well as aspects on developing and managing solid waste systems in a megacity. All four cities represented the emerging economies and share similar context and challenges in terms of managing waste and curbing greenhouse gases (methane) emissions from the sector.

The following key outcomes were achieved during the four-day programme with active and key participation from several local stakeholders at the international, national and city level – US EPA, GIZ, TERI, waste pickers’ NGO, private operators, chief engineers from three municipalities in Delhi:

1. The sharing of (good and bad) practices on finding alternate solutions and strategies to design sustainable waste systems. Whilst all three municipalities in Delhi gave detailed presentation about their waste management systems, the other participating cities also provided a detailed overview of their current waste management practices, highlighting challenges and what could be adopted from Delhi and vice versa.

2. Covering a range of aspects including technology, operations, legal, policy & financial components as well as public-private partnerships in setting up waste systems.
3. Informative site visits to observe different types of facilities such as landfills, integrated waste management systems, waste collection services, construction and demolition waste center, etc. and engagement with experts on-site.

4. Drawing out parallels between national level and respective city level waste policies to identify gaps in uptake of alternative solutions – energy tariffs, revenue streams for waste collection etc.

5. Connecting staff and establishing strong working relationships within a city’s waste and finance / treasury department staff members as well as between city staff officials.

Bringing together officials that share similar challenges in their respective cities led to extremely open, frank and engaged discussions in turn fostering South-South city-to-city collaboration. All participants challenged their peers and received sincere advice on how to avoid pit-falls while designing their own waste systems.

**List of participants**

**From Johannesburg, South Africa**
- Ms. Makhosazane Baker
- Mr. Mlawule Mashego
- Mr. Mabandla Sibisi
- Mr. Jerry Zulu

**From Quezon City, Philippines**
- Mr. Jack Guevarra
- Ms. Patty Orante

**From Rio de Janeiro, Brazil**
- Mr. Jose Penido

**From New Delhi, India**
- Mr. Pradeep Khandelwal
- Ms. Seema Awasthi

**On behalf of CCAC Waste Initiative**
- Ms. Aditi Ramola (ISWA)
- Ms. Amrita Sinha (C40)
- Ms. Nimmi Damodaran (Abt Associates)
1st May 2017

Visit to the 12 MW refuse-derived fuel (RDF) Plant, the Ghazipur Landfill site, and the landfill gas (LFG) recovery facility

The delegation travelled to the village of Ghazipur where they were welcomed by the team at the 12 MW RDF Plant. Mr. Pradeep Khandelwal, Chief Engineer of the East Delhi Municipal Corporation (EDMC), gave an introductory presentation about the waste management practices in East Delhi which was followed by a presentation about the 12 MW RDF Plant. The plant was commissioned by the EDMC and set up by IL&FS. Next was a presentation about the Landfill gas project by GAIL (Gas Authority of India Ltd.). Participants got to learn about the technology, operations, and financing of such a facility.

Tour of the 12 MW RDF Plant at Ghazipur

After the presentations, participants were given a detailed tour of the facility. The plant at Ghazipur processes 2,000 tons of waste per day, generates 12MW of power, and 127 tons of refuse-derived fuel (RDF). Since its operation, the plant has generated 13.6 million kWh of power and processed 244,000 tons of waste. Over its 25-year life, the plant is estimated to mitigate approximately 8.2 million tons of greenhouse gases (GHG) emissions – the equivalent of removing all the cars on Delhi roads for 100 days. The plant avoids the open dumping of 730,000 tons of waste annually.

The plant uses a pre-processing technology to produce good quality RDF, and as part of abatement measures for odor control, the waste is sprayed with an organic culture solution, the storage area is maintained at negative pressure and the odorous air is injected into the boiler.
The facility has an on-site double stage biological leachate treatment plant that utilizes an advanced Kurare PVA Gel technology from Japan.

Tour of the Ghazipur landfill site and landfill gas recovery facility
After the tour of the RDF plant, participants were driven to the neighboring Ghazipur landfill site. This landfill site has been in operation since 1984 and covers an area of 71 acres. The waste height has reached approximately 30 meters and the total accumulated waste is estimated at 4.7 million tonnes with nearly 2100 MT of municipal solid waste (MSW) being received daily.
At the Ghazipur dumpsite, EDMC in association with GAIL has set up a landfill gas (LFG) extraction facility. The pilot project is the first of its kind to have been installed on an active landfill site and extracts LFG from an area of 10 acres. The LFG flow is approximately 150 m$^3$/hr and has a methane concentration of about 25-35% by volume which is converted to 22-25 Kwh of electricity. So far, over 10,000 MT CO$_2$-eq of methane have been captured by the extraction plant. This project has been successfully validated and registered with UNFCCC for availing Clean Development Mechanism (CDM) benefits.

**Visit to the Gulmeher Livelihood Centre**

Located a few hundred meters from the Ghazipur dumpsite, the Gulmeher Livelihood Centre successfully demonstrates a sustainable business model centered on women’s groups in the Ghazipur slum community. It provides the women working there an alternative and sustained livelihood through usage of discarded flowers (about 8-10% of the total turnover) from the Flower Market to produce high quality products such as decorative items, greetings cards, colors, and recycled paper.

An IL&FS corporate social responsibility initiative, the Gulmeher Livelihood Centre is registered as a producer company with the women working there as shareholders. The centre is established within the waste-picker community, and anchors all social initiatives. The women are being organized to create a self-help group and the goal is to engage the community, especially women, and provide them a broader range of income streams that result in a safe and dignified occupation.

**Tour of the Construction and Demolition (C&D) Site at Shastri Park**

The delegation then travelled to the C&D site at Shastri Park which has been operational since November 2016. It is estimated that over 25-30 million tons of C&D waste is generated in India annually of which Delhi alone produces more than 4,000 tonnes. Due to improper disposal, this waste clogs rivers, blocks traffic and occupies dumping space.
To process the C&D waste produced in East Delhi, EDMC developed the C&D treatment plant through a public-private-partnership (PPP) model, in collaboration with IL&FS, over an area of 2.5 acres. The plant has the capacity to process 500 tons of C&D waste per day and is based on wet processing technology which helps reduce dust and noise pollution. The processing plant reduces the burden of waste being sent to the Ghazipur landfill site and produces valuable products such as tiles, concrete bricks/construction blocks, paving blocks and other building material. After being presented with the background and details of the plant, participants were given a guided tour through the facility.

2nd May 2017

Visit to Okhla 500 TPD Compost Facility and the Timarpur-Okhla 16 MW Waste to Energy (WtE) Plant

On day two, participants travelled to South Delhi to visit the composting and waste-to-energy plant in the suburban colony Okhla. Participants were welcomed by the waste managers and operators of the facility and given introductory presentations about the MSW management system in the zones overseen by the South Delhi Municipal Corporation (SDMC) before being given a tour through the plant. Several different types of vehicles are used for waste collection and dedicated route plans are set for each vehicle. Collection vehicles are double monitored – manually and by an automatic online real time monitoring system based on a GPS/RFID/Mobile Application.

Tour of the Okhla 500 TPD Composting Facility

The Okhla compost plant was set up by IL&FS under a PPP framework in association with the Municipal Corporation of Delhi (MCD) and is the first plant in the country to receive organic certification and carbon credits by the UNFCCC. Today, the plant processes 500 tons of MSW daily and produces 75 tons per day of organic compost which is compliant with the Fertilizer Control Order (FCO) of 1985.

The waste received is unloaded, presorted, then the sorted material is processed via windrow composting, post processed, refined, de-stoned and packaged for sale. Sorted material is stacked in windrows and turned every 4 weeks. The turned material is screened through trommels with different sized sieves. Sieved material is cured in ventilated sheds and further refined to remove fine inert material. Finished compost is stored and packaged for sale based on demand. The finished product is blackish-brown to black in color, crumbly in nature with an earthly odor. The pH of the product lies in the range of 6.5 to 7.5
with a Nitrogen-Phosphorus-Potassium (NPK) content of more than 1%. The C/N ratio in the range of 15-25. The facility also has a leachate treatment plant onsite and the water from the leachate treatment plant is reused.

Tour of the Timarpur-Okhla 16 MW WtE plant

The Timarpur-Okhla WtE plant was set up as a collaborative venture under a PPP model with a concession period of 25 years between the Jindal Group and the government of Delhi. Constructed over an area of 15 acres the plant has a capacity to process 2,000 tons of waste per day and generate 16-18 MW. It has an on-site leachate treatment plant and a fly ash brick making facility.

3rd May 2017

Day 3 began early with participants travelling to North Delhi to observe the door-to-door collection and transportation in the Rohini Zone. This was followed by a tour of the newly constructed integrated waste management facility at Narela-Bawana.

Waste management services in the Rohini Zone are undertaken by the North Delhi Municipal Corporation (NDMC). Door-to-door collection is done via the use of auto tippers which deposit the collected waste at temporary collection and segregation points also known as ‘dhalaos’. Waste from these locations is then collected by larger vehicles and transferred to processing facilities / disposal sites such as the Narela-Bawana landfill in the case of waste from Rohini Zone. MSW is then processed, treated and disposed of at these facilities. The pictures on the right show a ‘dhalaos’ or temporary waste storage facility as well as the different types of vehicles used for waste collection across the city.
Participants followed an auto tipper as it made its journey through a residential colony and got to observe the door-to-door collection of waste in action. The vehicle was equipped with a special horn which signaled to the residents that the waste collectors were waiting to take the waste from their homes. Residents made their way out of their homes to empty waste containers into the auto tipper. Once full the vehicle off-loads its waste at a ‘dhalao’.

For hard to get places with narrow streets, rickshaws are used. The rickshaws also take the waste to ‘dhalao’. From the ‘dhalao’, waste is collected and transported by the use of hygienic & GPS equipped covered transport vehicles to waste processing facilities / landfill sites. As can be seen in the photo below some auto tipper can also transfer the waste directly to large waste collection trucks.
Visit and tour of the integrated waste management facility at Narela-Bawana

The integrated MSW facility at Narela-Bawana with a waste handling capacity of 2,000 TPD was set up by DELHI MSW SOLUTIONS LTD (SPV) of Ramky Enviro Engineers Ltd. under a PPP model with the North Delhi Municipal Corporation. The facility is spread over an area of 100 acres and consists of a segregation plant, compost plant, a RDF waste to energy plant, and an engineered landfill.

The WtE plant at Narela-Bawana processes 2,000 MT garbage to produce 24 MW electricity. This plant’s capacity can be extended to handle 4,000 MT garbage and produce 36 MW electricity in the future.
Day of discussions at The Energy and Resources Institute (TERI)

Participants were welcomed to TERI by Dr. Suneel Pandey who gave a brief introduction of the institute and all the projects they are involved in. All participants then briefly introduced themselves to the group. Following this, there were two presentations on the National Municipal Solid Waste Management Handling Rules of 2016 and the role of the informal sector. After each presentation, the participants had the opportunity to ask relevant questions.

Discussion on India’s National Municipal Solid Waste Management Handling Rules 2016

Ms. Shweta Dua from GIZ gave a presentation on the India’s newly updated National Municipal Solid Waste Management Handling Rules of 2016. She elaborated the difference between the original rules from 2000 and the updated rules from 2016, stating that the new rules place very strict responsibilities and timelines by the Ministry of Urban development (MoUD). The updated Solid Waste Management Rules of 2016 make it mandatory for waste generators to segregate waste at source into 3 streams (wet, dry and domestic hazardous) and ban the open burning of waste. Further, the rules focus on recycling and recovery, community participation, decentralized treatment, material recovery facilities (MRF), and extended producer responsibility (EPR) for waste streams. They also acknowledge and formalize the important role played by the informal sector. Enforcement is to be carried via penalties / fines through by-laws developed by the urban local bodies (ULB) at the city level.

Question: Who are these ULBs and how do they get the needed money to finance these things?

The ULBs here are not rich, the government provides the money for SWM and the main source of income for ULBs is through tax collection. Waste management is not the only service that ULBs are responsible for – they also provide water, roads etc. and SWM tends to be given lowest priority. They provide mostly collection and transportation services of waste without processing.

Question: What is the penalty for the ULB if they don’t comply?

The Central Pollution Control Board (CPCB) of India, which is a statutory organization under the Ministry of Environment, Forest and Climate Change (MoEF&CC), regularly inspects the facilities and they can fine the municipality/ULB. The national green tribunal (NGT) can summon the highest authority of the ULB to court and ask why they are not complying with rules and regulation. Penalty can be as severe as imprisonment.

Question: Do EPR guidelines exist? How effective are they?

No guidelines for packaging yet – it is the most important scheme. This scheme was newly introduced, and the government is working on the EPR guidelines.

Question: What is the structure of compliance and enforcement at all levels? How is it enforced?

The way waste management services are structured in India is that the central government sets the rules, the state government interprets them and takes action, and the urban local bodies (ULBs) implement
them. Targets for violation rates are only at the state level. The MoUD developed service level benchmarks, one for instance is that 100% door-to-door collection should be provided to the citizens. However, the “not in my back yard” NIMBY sentiment remains a challenge.

Presentation on the role of the informal sector and NGOs involved

Mr. Ashish Jain, Director, Indian Pollution Control Association (IPCA), gave a presentation on the role of the informal sector in waste management. He described how their organization is working with communities to reduce waste and promote recycling waste pan India. There are over 1 million waste pickers in India that are engaged in waste collection. There is an effort to integrate rag pickers (informal waste pickers) into the formal waste sector through capacity building and training programmes. These people are working voluntarily to provide free door-to-door collection. They do not charge the ULB, citizens etc. Waste pickers are known as friends of the environment, however, they are volunteers with no rights and they are exposed to all kinds of wastes and face health hazards while working. IPCA is working towards bringing basic rights and equipment to rag pickers. Segregation of waste at source is mandatory since Solid Waste Management Rules 2016 and littering and burning of waste is punishable offense.

Question: Have you seen good recycling companies producing/following standards for products? Where are those standards? Who are those right recyclers? Are they registered with government of India?

Yes. It is a mandate of the government to publish a list of authorized recyclers. Our organization helps with capacity building, empowering the rag pickers includes taking into account the environment and helping remove the stigma of untouchability from society. We go there to their location and train in groups of 20 to 30 people.

Question: How are you getting funds? Is it a self-sustainable model? How is the revenue distributed? What if the waste picker directly gives to the recycler, compared to what you are giving them? How much do they earn?

They definitely earn less, but we are promoting capacity building. They earn approximately 20,000 rupees per month or more depending on the amount of waste they bring in. They don’t get paid regular salary. Till now there wasn’t any rule but now we should register them and give them identity. Different cities have engaged rag pickers in different ways. For instance in Pune, they do it through cooperatives etc. ULBs have regular staff and contractual staff. We can’t do much without the help of rag pickers so every ULB and state are trying to find a solution.

Question: How to collect a fee for WM?

It is expressed as a separate line item but can incorporated waste service fee. There exists a max ceiling but the rate can vary. In most cities even if you charge a fee you are not able to cover the cost. No mayor who wants to increase the fee. Ideally it would be helpful say in Delhi if the government could pay the incentives.

In Quezon City, they put it on top of property tax. SWM is a social service not an economic one.

In Johannesburg, it is a line item part of other services, poor communities completely exempted from these fees.
In Rio, it is only a collection tax which is measurable not including sweeping etc.

In the afternoon session participants were asked to write questions for each of the below topics that were then addressed by the group.

**Topic: Waste to Energy**

The cost of WtE plants cost 15 crore/2.8 million USD per MW installed capacity.

Major challenges are:

1. Quality of the waste
2. Land site, availability of land
3. Emissions control.

*Question: Taking the example of Delhi what are the key lessons learned/what would you do differently?*

Given the current situation, WtE is the only solution for waste management utilizing tariff (output based) based bidding – output based bidding is preferred by the municipal corporations in charge.

**Tip for elaborating a WtE contract: The key performance indicators should be strong, objective and elaborate. The contract should be two sided – there should be penalties and incentives.**

*Question: What are the most critical things to consider to ensure profitability and sustainability? Is PPP the best model to implement this?*

Tariffs are extremely critical to consider to ensure the success and long term sustainability of the project. Another thing to consider for success is that PPA (power purchasing agreements) should be allowed. WtE can only be successful if there is a PPP model. Government support can be in the following: help in acquiring land/space, guaranteeing an adequate quantity of waste, helping with environmental clearances, helping with public resistance. Before you go ahead with the project, one has to make sure that there is buy in from the local citizens. Several projects fail because people over estimated the amount of waste.

**Outcomes and next steps**

After four productive and informative days of the visit where several ideas were shared between the participants each went back motivated to implement what they had learned from the several discussions. Below are some of the main ideas the participants would like to implement when they are back in their respective cities.

- The city of Johannesburg is considering reaching out to their buildings department to stop illegal dumping of C&D waste and mixing with municipal waste. They are looking for ways to enforce taxes using the “polluter pays” principle for the waste generated by developers. They will also include some ideas on C&D waste treatment to save precious space at the landfill site. They will explore the use of hand carts, or similar vehicles, in hard to reach areas and incentivize the informal waste pickers to coordinate collection services.
- Rio de Janeiro is thinking of incorporating economical and PPP design learnings in their planning for a waste facility in Caju, integrated with the MRF and biomethanization plants.
- Quezon City decided to revise their approach to developing integrated waste management facilities in the city. They want to do due diligence before developing alternative waste technologies, including proper assessment of the waste composition. Other cities are keen to learn from Quezon City about their segregation at source policy.

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The cities requested to create a repository of all the legal documents/ RFPs tenders to access and learn from.

All presentations from the city exchange can be found: here.

All useful documents including samples of new calls for tender, contracts, terms of reference, financing checklist from CCAC etc. can be found: here.
Annex – Agenda

Agenda

City Exchange Programme: New Delhi, India

30th April – 4th May 2017

Day 0 – Sunday, April 30 2017

AM-PM Arrival in Delhi
Participants picked up at the airport and taken to the hotel
Agendas given out and participants briefed about the programme

Day 1 – Monday, May 1 2017

06:00-08:00 Breakfast in the hotel
08:15-08:30 Meet in the hotel lobby
08:30-09:30 Travel to Ghazipur
9:30-10:15 WELCOME NOTE
Overview presentation about waste management practices in EDMC and presentation on the use of GPS software in collection and transportation services
10:15-11:00 Presentation on landfill gas recovery (LFG) and energy recovery
11:00-11:15 Tea break
11:15-12:00 Tour of the 12 MW RDF Plant at Ghazipur
Learn about the technology, operations, and financing of such a Facility for the treatment of non-recyclable materials and management of landfill site for final residual disposal
12:00-12:15 Travel to Ghazipur landfill site and landfill gas recovery (LFG)
12:15-13:00 Tour of the Ghazipur landfill site
Learn about the pilot LFG plant employed on an active landfill site, first of its kind in India using micro-turbines
13:00-13:10  Travel to Gulmeher Livelihood Centre
13:10-13:30  Tour of the Gulmeher Livelihood Centre
13:30-14:30  Lunch break at Ghazipur
14:30-15:00  Travel to EDMC head office, Patparganj
15:00-15:50  KICK-OFF SESSION
  Welcome note by the Municipal Commissioner (10 minutes)
  Introduction to CCAC, C40 and ISWA (10 minutes)
  City Introductions – Johannesburg, Rio de Janeiro, and Quezon City
  officials (30 minutes)
  Defining objectives and expectations from the exchange- C40/ISWA
15:50-16:15  Travel to Construction and Demolition Site, Shastri Park
16:15-16:30  Tea/Coffee break
16:30-17:00  Tour of the Construction and Demolition Site at Shastri Park
17:00-17:30  Discussion session
  Dive deep into questions/concerns/interests with facility specialists.
  Open and informal Q&A session between officials and facility operators.
  (Guiding questions are part of the annex)
17:30-18:30  Travel to hotel
19:00-21:00  Group dinner with city officials and Mr. Khandelwal and Team

Day 2 – Tuesday, May 2 2017
06:00-08:00  Breakfast in the hotel
08:15-08:30  Meet in the hotel lobby
08:30-09:30  Travel to South Delhi Municipal Corporation and their waste management
facilities
09:30-11:00  Overview presentation about waste management practices in South
Delhi
11:00-13:00  SITE VISITS – Okhla
  Tour of the Okhla 500 TPD Compost Facility
  Tour of the Timarpur- Okhla 16 MW plant
13:00-14:00 Lunch break
14:30-17:00 (including tea/coffee breaks)
Discussion session
Overview on energy recovery
Dive deep into questions/concerns/interests with facility specialists. Open and informal Q&A session between officials.
(Guiding questions are part of the annex)
17:00-18:00 Travel to the hotel
18:00-21:00 Evening free; recommendations for city tours (Dilli Haat, Red Fort), dinner

Day 3 – Wednesday, May 3 2017

06:00-07:00 Breakfast in the hotel
07:00-07:15 Meet in the hotel lobby
07:15-08:30 Travel to North Delhi Municipal Corporation, North Delhi
08:30-10:30 Observe the door-to-door collection and transportation in Rohini Zone
10:30-11:00 Travel to Narela-Bawana site
11:00-12:30 Tour of the integrated waste management facility at Narela-Bawana
12:30-13:30 Lunch break
13:30-16:00 (including tea/coffee breaks)
Discussion session
Dive deep into questions/concerns/interests with facility specialists drawing synergies for respective cities.
Open and informal Q&A session between officials.
(Guiding questions part of the annex)
16:00-17:00 Travel to the hotel
19:00-21:00 Group dinner with city officials

Day 4 – Thursday, May 4 2017

06:00-08:00 Breakfast in the hotel
08:15-08:30 Meet in the hotel lobby
08:30-09:00 Travel to The Energy and Resources Institute (TERI)
09:00-13:00 Welcome note by TERI (10 minutes)

Introductions (15 minutes)
Discussion on India’s National Municipal Solid Waste Management Handling Rules 2016 by experts from GIZ (30 minutes)
Recap of all three days/review challenges observed over the past three days (2 hours)
  • Collection, transporting and recycling waste – involving the informal sector
  • Management of organic waste
  • Waste to energy
  • Dumpsites and landfills

(PPPs will be cross-cutting and will be discussed in each of these sessions)

13:00-14:00 Lunch break
14:00-15:00 Closing session
Discussion on financing of projects (30 minutes)
Participants describe the next steps including activities and commitments that they will follow up on. (15 minutes)
Closing remarks (15 minutes)
Participants describe experience and thank you from organizers
15:00-15:30 Travel to the hotel
PM Free evening. Drop-off to airport. Departures from Delhi.