EU Project on
Technical Cooperation for Environment in India
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June 2017 Study Tour to Stockholm & Munich Summary Report
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Contracting Agency

The Delegation of the European Union to India, Delhi

Project Consultants

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and

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Delhi, India**

1 Project Background

The aim of the Technical Cooperation for Environment in India project is to contribute towards India's sustainable and inclusive development objectives based on the local experience of both India and the EU through capacity building and skill development.

The focus of the project is on two priority themes viz. (1) Solid Waste Management and (2) Sewage Treatment in two pilot cities viz. Mumbai and the National Capital Territory of Delhi. The expected outcomes of the project are:

- Enhanced technical and institutional capacity of Indian authorities to create an enabling environment promoting clean technologies;
- Enhanced human capacity through the transfer of the required skills and technical know-how for the use and development of clean technology in the local context;
- Increased awareness amongst public and private actors and the public at large, on environmentally friendly development activities.

This report provides information about the contents of the study tour of June 2017, the conditions in Sweden, Germany, and India, key events, areas of future cooperation, etc.

2 Study Tour Information

Within this framework and as part of WP-6 "WP 6-Training programs to encourage stakeholders to switch over to climate change and resource efficiency technologies" (Para 6.3: "Study tours to Europe and training by EU experts") of the approved Inception Report, a 1-week Study Tour took place from June 17th-24th, 2017 in Stockholm, Sweden and Munich, Germany.

The purpose of the tour was to build advanced capacity, develop synergies and identify areas of cooperation on solid waste management and sewage treatment, as these represent key challenges for India and can contribute to the Swachh Bharat mission and the National Action Plan on Climate Change. Sweden and Germany were selected given their focus on the waste management hierarchy, utilisation of a range of modern technologies, and significant achievements in both areas of interest. The study tour was implemented in accordance to the concept that was initially developed in April 2017 and regularly updated.

Fifteen policy makers and technical experts from the Ministry of Urban Development, Ministry of New and Renewable Energy, Central and Maharashtra Pollution Control Boards, North and East Delhi Municipal Corporations, Municipal Corporation of Greater Mumbai, and the Delhi Jal Board attended. A number of project team members from Sweden and India contributed to the study tour. The study tour focused on:

1. Interactive sessions with experts from IVL-Swedish Environmental Research Institute, smart cities, waste management and sewage treatment facilities, etc. on technical, policy and legal issues including processes, regulatory framework, statistics, challenges and solutions.

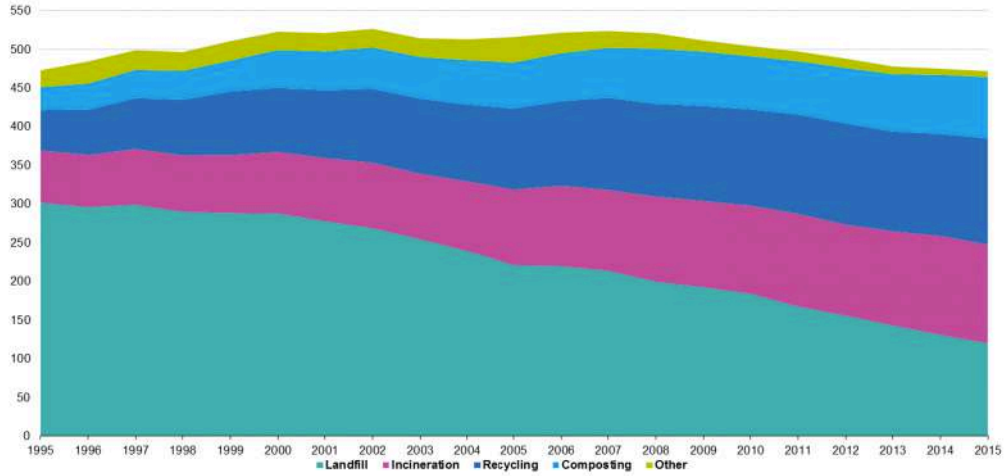
2. Site visits to biogas, waste to energy, composting, restored landfill, sewage treatment, recycling, and other facilities as well as to sustainable urban projects (i.e., Hammarby Sjostad). The site visits

provided the opportunity to directly observe operations and examine with the operators success factors and challenges.

3 Main Features of Waste Management[1]

In 2014 every person in the EU generated on average 475 kgs of municipal waste, of which 465 kgs were treated as follows: 28% was recycled, 28% landfilled, 27% incinerated and 16% composted. There is a steady increase of the share of composting and recycling from 17% in 1995 to 44% in 2014. Figure 1 shows the evolution of waste treatment in Europe.

Figure 1: Municipal Waste Treatment by Type of Treatment in EU-27 (Kgs per capita; 1995-2015)



3.1 Sweden

In 2015, Sweden generated 4.5 million tonnes of household waste. More than 99% of all household waste is recycled. The country has gone through a “waste recycling revolution” in the last few decades as only 38% waste was recycled in 1975. The evolution is shown in Figure 2, while Figure 3 shows the key policy interventions that have gradually led to this “revolution.” Specific targets, taxation, bans, and national plans are key ingredients of success.

[1] This section relies on information from European Environment Agency-EEA, Country Fact Sheet, Municipal Waste Management, Germany, October 2016; European Environment Agency-EEA, Country Fact Sheet, Municipal Waste Management, Sweden, October 2016; Eurostat Press Release, 56/2016, 22/3/2016, Environment in the EU; Avfall Sverige, Swedish Waste Management, 2016; S. Cave, Recycling in Germany, Research and Information Service Briefing Paper, January 2017; http://ec.europa.eu/eurostat/statistics-explained/index.php/Municipal_waste_statistics accessed on 8/7/2017.

[2] This section relies on information from the European Commission, Final Implementation Report for the Directive

Figure 2: Evolution of Waste Management Treatment in Sweden, 1975-2015

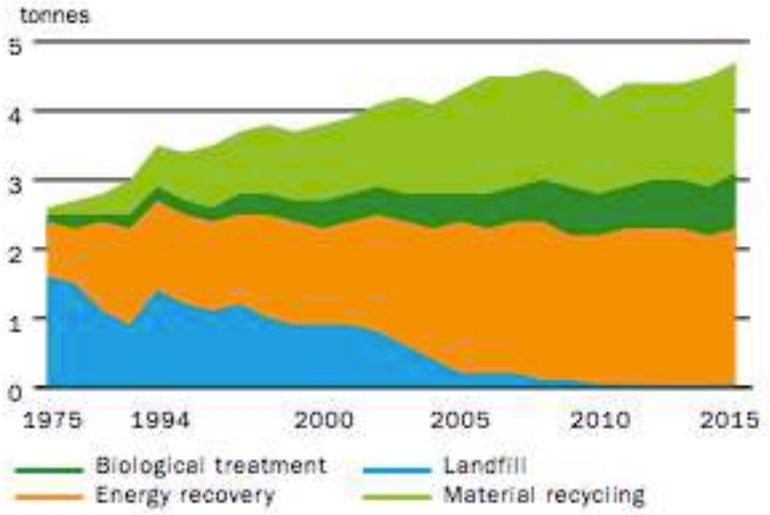
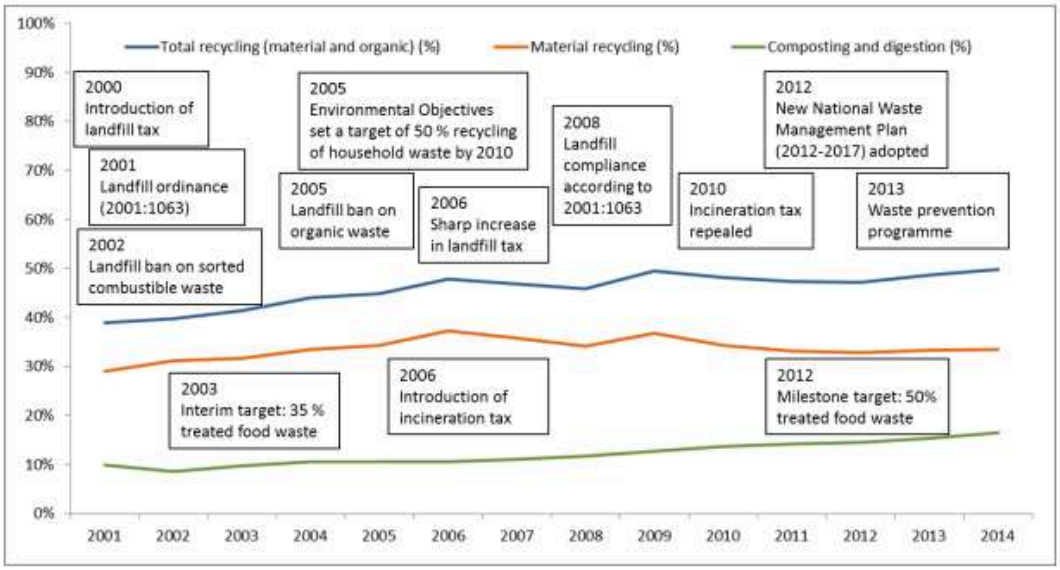


Figure 3: Key Policy Interventions of Waste Management in Sweden



The key conclusions of Sweden's policy are the following (EEA, 2016):

- The overall treatment of municipal solid waste in Sweden is characterised by an equal share of recycling and incineration, more than 49 % each, while landfilling has been diminished to around 0.6 % of generated MSW in 2014.
- Recycling rates were already high in 2001 at 39 % and by 2014 they reached almost 50 %.
- Sweden will most likely be able to fulfil the 2020 50 % target set out in the Waste Framework Directive.
- A landfill tax, which came into force on 1 January 2000, played a vital role in the diversion of MSW from landfill to recycling and incineration. Consecutive increases in the tax level in 2002, 2003 and finally in 2006 instigated a continuous reduction of landfilling MSW.

- In addition to the landfill tax, other instruments such as producer responsibility, milestone targets for food waste recycling and investments in anaerobic digestion have been particularly important in improving recycling rates.
- A landfill ban on sorted combustible waste in 2002 and a landfill ban on organic waste in 2005 were catalysts for the diversion of MSW from landfills.
- Since 2012 Sweden has two milestone targets for waste, including a target of better resource management in the food chain and recycling target for construction and demolition waste.
- A tax on incineration was introduced in 2006 in order to boost further material and organic recycling, but was repealed in 2010.

3.2 Germany

In 2014, Germany generated 618 kgs of municipal waste per person; of which 47% was recycled, 17% composted, 35% incinerated and 1% landfilled. Figure 4 shows the evolution of Waste Management Treatment in Germany and Figure 5 shows the key policy interventions in Germany including taxation, bans, and national plans.

Figure 4: Evolution of Waste Management Treatment in Germany, 2001-2014

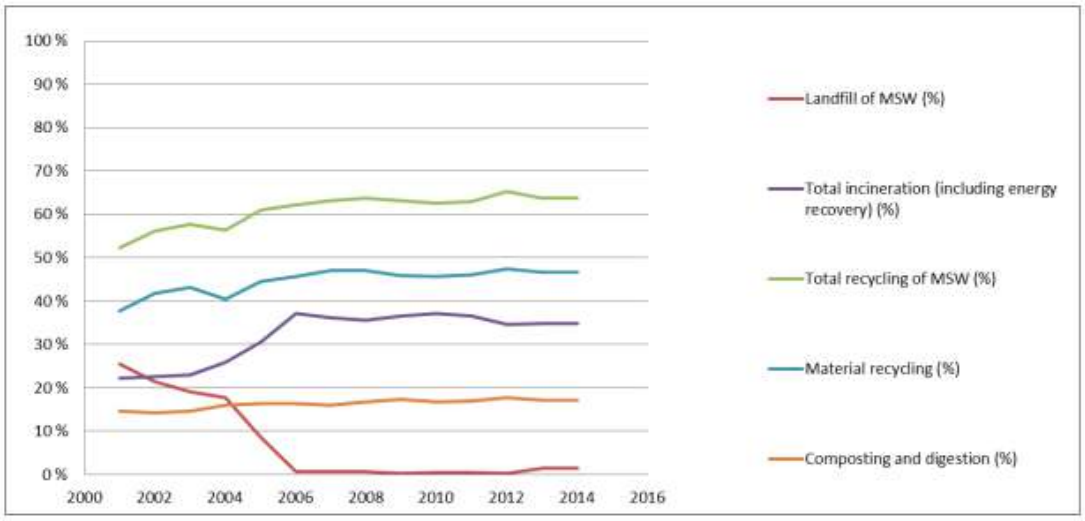
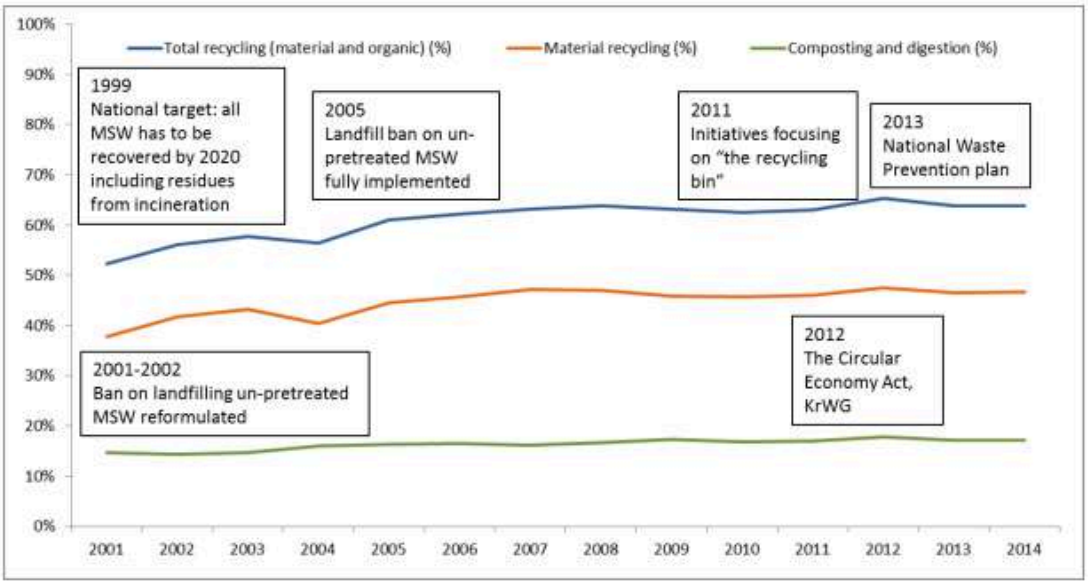


Figure 5: Key Policy Interventions of Waste Management in Germany



The key conclusions of Germany's policy are the following (EEA, 2016):

- Recycling has increased from 52 % of municipal waste generated in 2001 to 64 % in 2014. The EU target of 50 % recycling by 2020 has already been met.
- The 2016 target for biodegradable municipal waste sent to landfill was met in 2006.
- There is a long tradition of national waste strategies and waste management plans in the federal states.
- A ban on landfilling un-pretreated MSW, producer responsibility and a focus on separate collection have proved to be important policy initiatives.
- The latest initiatives are the introduction of the so-called recycling bin – to be adopted by the municipalities on a voluntary basis – that aims to increase recycling of plastics and metals from households, and the mandatory separate collection of bio-waste from 2015.

3.3 India

In India, 62 million tonnes of waste are generated annually by a population of 377 million in urban areas, of which 75-80% of the solid waste is dumped at the landfills, while only 20-25% is processed & treated. 1.240 ha of land per year is presently required for dumping and by the year 2031 the requirement of land would be 66.000 ha. In order to treat or process solid waste, there are 535 compost/vermi-compost plants, 22 RDF/pallets plants, 41 bio-gas plants and 13 power plants.

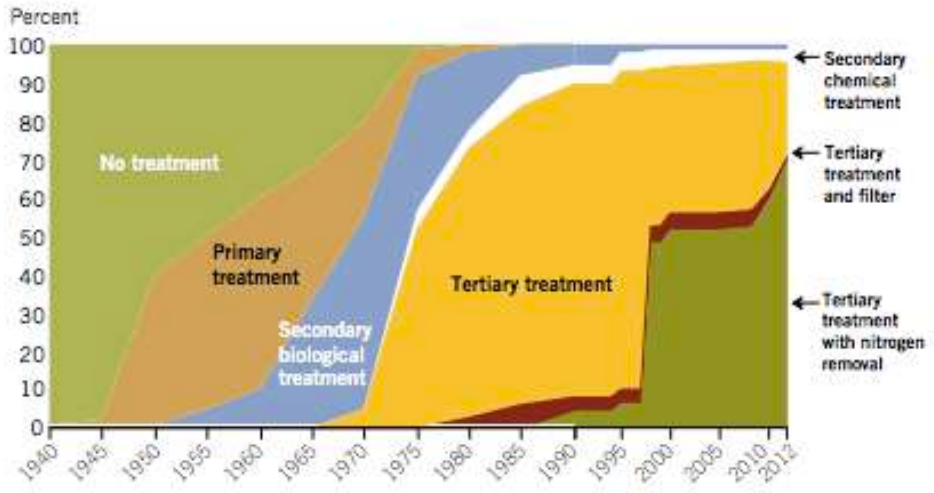
4 Main Features of Sewage Treatment[2]

4.1 Sweden

In Sweden, all households in urban areas are connected to sewage treatment plants. There are more than 400 plants managing around 1.25 billion m^3 of sewage annually. The treatment is in most cases based on a combination of mechanical, biological and chemical processes (Figure 6). Generally, mechanical solids removal is the first step. The most common treatment methods are 1. Biological treatment; 2. Chemical treatment; 3. Biological-chemical treatment (conventional three stage treatment); 4. Biological-chemical treatment with separate de-nitrification processing; 5. Biological-chemical treatment with supplemental treatment (as with filtration).

Because of treatment plants that were built in the 1960s and 70s, releases of phosphorus and organic matter decreased significantly. Similarly, from the mid-1980s new methods were used to reduce nitrogen levels also. The degree of purification for phosphorus, biochemically degradable organic matter (BOD), and nitrogen has improved overtime. Furthermore, in 2012 Sweden generated more than 207.000 tonnes of sludge from the treatment plants.

Figure 6: Evolution of Sewage Treatment in Sweden

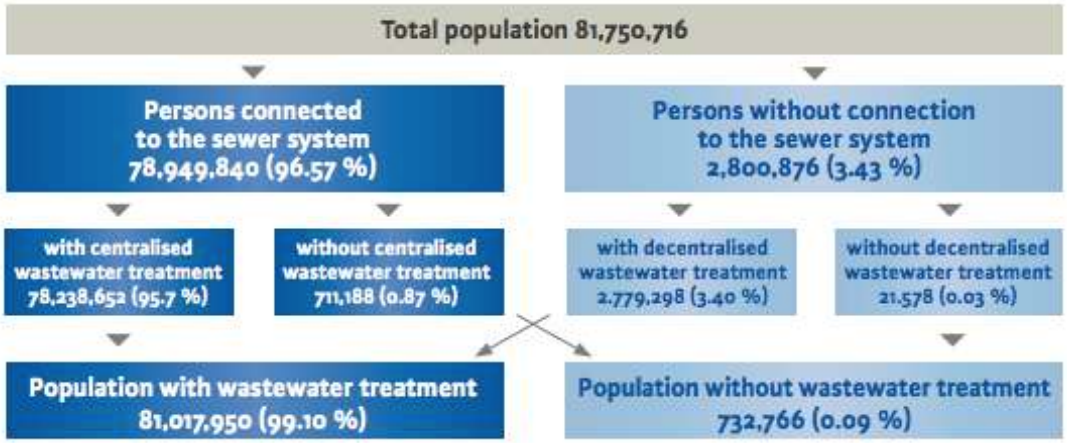


4.2 Germany

In Germany, there are more than 6.900 treatment plants, managing around 10 billion m^3 of sewage annually. Around 97% of sewage is treated to the highest EU standards (Figure 7). Germany generates around 2 million tonnes of sludge from the treatment plants, while the use of sludge thermal processing is increasing in significance.

[2] This section relies on information from the European Commission, Final Implementation Report for the Directive 86/278/EEC on Sewage Sludge, 2015; Umwelt Bundesamt, Sewage Sludge Management in Germany, 2013; Wvgw Wirtschafts- und Verlagsgesellschaft Profile of the German Water Sector, 2015; https://www.destatis.de/EN/FactsFigures/NationalEconomyEnvironment/Environment/EnvironmentalSurveys/WaterSupplyIndustry/WaterSupplyIndustry.html;jsessionid=E1AF53AF8B9AC2DAEE6F3B5566C74FE0.cae1 accessed on 8/7/2017.

Figure 7: Degree of Sewage Connectivity in Germany



4.3 India

Sewage generation in urban area is approximately 38.000 Million Litres per Day (MLD), whereas the treatment capacity is around 23.000 MLD out of which operational capacity is only 19.000 MLD through 522 operational sewage treatment plants. Tentative sludge generation is 9.000 tonnes per day.

5 Main Areas for Cooperation

The key areas of cooperation based on the study tour as well as the ongoing work with the Indian stakeholders are the following:

1. Technical and policy contribution on solid waste management issues, especially in relation to waste transfer stations, landfill mining, and sewage treatment oversight.

2. Larger focus on the feasibility of landfill mining, as it potentially incorporates some important benefits for waste management and urban development that are relevant to Mumbai and Delhi. The presentation by professor Fricke in Munich, introduced some key issues that require further examination regarding technical solutions, costs, etc. The Project is examining how it can provide relevant support, within the project's budget and time constraints.

3. Finalisation of the e-learning modules on community waste management and the continuation of the awareness initiative in cooperation with Stree Mukti Sanghatana is of high importance. At the study tour it was evident that community awareness is a key aspect of efficient waste management in Sweden and Germany.

4. Propositions for best methodologies for the reuse and application of sludge (e.g., incineration, agriculture). Furthermore, the presence of phosphorus in sludge and the technologies for its recovery represent additional areas for potential collaboration.

6 Agenda

The agenda is presented in Figure 8. All presentations and reports have been placed on the project's website (www.euprojectinindia.com) for easy access by all parties. Photos are available in Annexure I. The evaluation forms by the participants provided positive feedback about the contents and planning of the study tour.

Figure 8: Study Tour Agenda

Date	Activity
Saturday 17/6	• Flights to Stockholm (Arrival on Saturday 17/6)
Sunday 18/6	• 17.30-22.00 Dinner at Fjader island
Monday 19/6	• 08.30-12.15 Opening session & presentations at Smart City House in Hammarby Sjostad (HS) ♦ Welcome and project presentation, P. Karamanos, Team Leader, EU-India Project ♦ Wastewater & waste management presentation, V.K. Verma, Alternate Team Leader, EU-India Project ♦ Smart city Sweden, O. Ekengren, Executive Vice President, IVL ♦ Hammarby Sjostad, unique environmental project in Stockholm & site visit, E. Freudenthal, Manager, Glashus Ett • 13.00-14.30 Scandinavia Biogas, Site visit and presentation, J. Collin, Head of Technical Department • 14.30-15.30 Hammarby Sjostadverket, Sewage treatment demonstration plant, S. Philipsson, IVL
Tuesday, 20/6	• 07.00-18.00 Borlange waste to energy plant presentation and site visit, M. Bjurman, Production Manager, Borlange Energi
Wednesday 21/6	• Travel to Munich
Thursday 22/6	• 09.00-16.00 Visit to City of Munich recycling facility; Waste management in the City of Munich presentation, G. Langer, City of Munich; Visit to composting/biogas facility and restored landfill • 17.00-19.30 Landfill mining - A contribution of waste management to resource conservation, Professor K. Fricke, Technical University of Braunschweig & Solid waste management in Mumbai presentation, P. Awate, Chief Engineer SWM Project, MCGM
Friday 23/6	• 09.00-14.00: Sewage treatment operations in the City of Munich presentation, Dr. Bohm; Visit at Gut Grosslappen sewage treatment plant; Concluding remarks of study tour.
Saturday 24/6	• Departure to India

Annexure I: Photos





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