EU Project on Technical Cooperation for Environment in India

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Sludge Management & Solid Waste Management Study Workshops Summary Report

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Contracting Agency

The Delegation of the European Union to India, Delhi

Project Consultants

Swedish Environmental Research Institute

in consortium with

Danish Technological Institute, Taastrup, Denmark

and

Shriram Institute for Industrial Research, 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.

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 Sludge Management Study Workshop took place from June 4th-11th 2016 in Sweden and Denmark as well as a 1-week Solid Waste Management Study Workshop from June 11th-18th in Stockholm.[1]

This report provides detailed information about the contents of the workshops, the conditions in the EU, Sweden and India, key events, areas of future cooperation, participant profiles and feedback, etc.

2 Main Features of the Waste Management System in Europe/Sweden

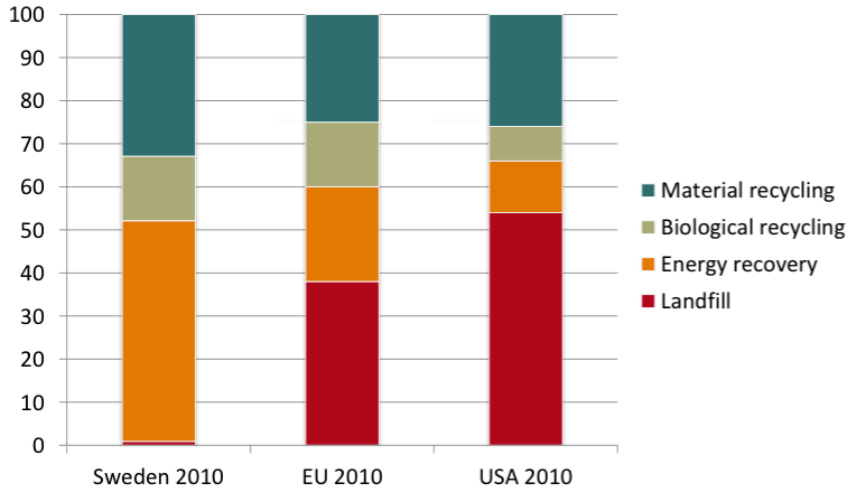
In Europe, and in particular in Sweden, more than 99% of all household waste is recycled. The country has gone through the era of "waste recycling revolution" in the last few decades as only 38% waste was recycled in 1975. During 2013, the matrix of treatment, processing & disposal of solid waste in Sweden were:

- 1.46 million tonnes (33% of waste) for material recycling.
- 0.71 million tonnes (16% of waste) for biological treatment.
- 2.23 million tonnes (50% of waste) for waste-to-energy
- 0.033 million tonnes (0.7% of waste) for landfilling.

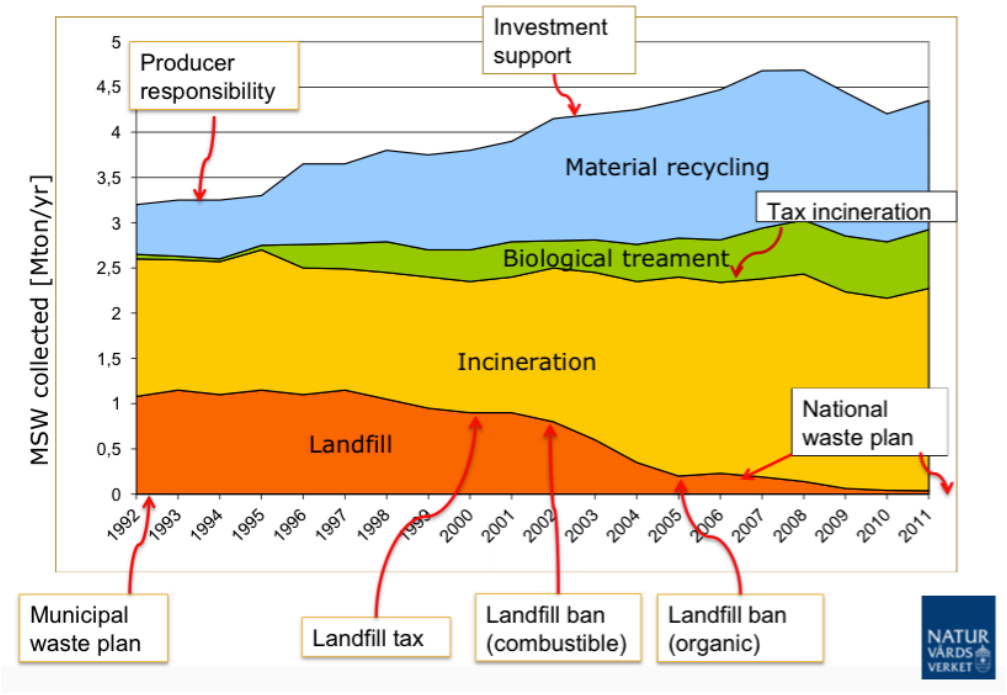
In addition, 374,000 tons of sludge (dry solids) per year sludge is generated in Sweden, which contains about 75% organic matter. There are 233 plants generating biogas from sewage with the generation of 1.400 GWh energy.

[1] The workshops were implemented in accordance to the concept that was initially developed in March 2016 and updated.

Waste Management in Various Regions



Treatment of Household Waste in Sweden



Within this framework, the future target of India would be "Zero Landfilling" by adopting the 5-R concept of the waste management hierarchy.

In order to achieve above objective, there is an urgent need to build the capacity of stakeholders together with the exchange of best practices to create enabling environment.

3 Main Areas for Cooperation

The workshops have led to a number of key lessons based on the experience in the EU and India and the identification of relevant areas for cooperation:

1. The effective implementation of environmental policies in Europe and Sweden has been a gradual process which requires planned actions, including target setting, division of responsibilities, collaboration between private and public sectors, source separation, financing, etc. Consequently, a review of EU policies and legislative framework and applicability to India is beneficial.

2. Public awareness, communication and engagement represent important prerequisites for effective policy implementation in Europe. Capacity building and awareness are also key components of the recent Indian Solid Waste Management Rules of 2016, and therefore exchange of experience in this field will be productive.

3. Technologies and processes for the pre-treatment of waste, material separation, and energy recovery have been essential components for successful waste management in Europe. Thus, collaboration on technology development, process optimisation, compliance with norms, etc. can be further developed.

4. The presence of phosphorus in sludge and the technologies for its recovery represent areas for collaboration. Similarly, best methodologies for the reuse and application of sludge (e.g., agriculture) will be on high demand.

A key aspect of the discussions focused on the themes for the forthcoming four consultation workshops that will take place in New Delhi and Mumbai during November 2016-February 2017.

4 Sludge Management Study Workshop

4.1 General Information

The 1-week Specialized Sludge Management Study Workshop took place from June 4-11 2016 in Malmo/Sweden and Copenhagen/Denmark. According to the approved Inception Report, enhancement of sludge utilization is one of the project's priority areas.

The purpose of the workshop was to build advanced capacity and develop synergies on sludge management, as this is one of the key challenges in India and can contribute to the Swachh Bharat mission and the National Action Plan on Climate Change. It has also been important at this stage of the project to develop networks with EU companies, expand the knowledge base, and identify areas of cooperation. The specific locations were selected in order to take advantage of the 3-day Holistic Sludge Management Conference as well as of the relevant expertise of IVL-Swedish Environmental Research Institute (consortium leader) and the DTI-Danish Technological Institute (consortium partner).

Given the specialized nature of the workshop, a small number of representatives were invited. Five environmental specialists from the Ministry of Urban Development, Delhi Jal Board and the Municipal Corporation of Greater Mumbai attended the workshop. The Delegation of the European Union to India was represented by Mrs. F. Renzi, Programme Manager, while a number of project team members contributed to the workshop.

The workshop focused on:

1. Interactive sessions with experts from Danish Ministry of Environment, IVL, DTI, etc. on technical, policy and legal issues of sludge management, including processes, EU, Swedish, Danish, and Indian regulatory framework, statistics, and challenges.

2. Site visits at a sewage treatment and sludge management facility, waste to energy plant, and public information center. The site visits provided the opportunity to directly observe operations and examine with the operators success factors and challenges.

3. Attendance of the 3-day Holistic Sludge Management Conference (http://www.hsm2016.se). The conference was a forum for practitioners and researchers to exchange the latest developments regarding holistic sludge management.

The conference examined the different challenges and solutions connected to resource recovery through treatment and handling of wastewater/sludge (e.g., technical issues, legal/policy aspects). The following topics were covered, which are directly relevant to the Indian case:

- Holistic sludge management
- Sludge minimization
- Sludge reuse and disposal
- Recycling of materials from sludge
- Energy recovery

Figure 1 presents the agenda of the study workshop.

Figure 1: Sludge Management Study Workshop Agenda

Date	Activity
Saturday 4/6	• Arrival of delegation and project team.
Sunday 5/6	• Copenhagen city tour with an environmental focus.
Monday 6/6	9.30-14.00: Meeting at DTI offices, Hoje Taastrup, Denmark • Welcome/Presentation by Vice President D. Tveit, DTI Energy and Climate. • EU overview & project presentation, Dr. P. Karamanos, EU-India Project • Wastewater/Sludge management presentation, Dr. V.K. Verma, EU-India Project • Presentation by Veterinary Linda Bagge, Ministry of Environment and Food of Denmark, Danish Environmental Protection Agency. • 10' presentations by Indian representatives on responsibilities/conditions/challenges from Ministry of Urban Development, Delhi Jal Board, Municipal Corporation of Greater Mumbai. • DTI's activities and visions in the field of wastewater and sludge. Presentation by Consultant Klaus Litty, DTI Life Science, Centre for Water and Resources. 14.30-16.00: Sludge in a Danish Context – site visit to Fors A/S' Roskilde wastewater plant. 17.30-19.00: Conference ice-breaker and registration at Malmö Arena Hotel.
Tuesday 7/6	11.00-17.30: Holistic Sludge Management Conference. 17:30-19.30: Welcome reception at Malmo City Hall.
Wednesday 8/6	8.30-16.40: Holistic Sludge Management Conference. 18.30: Conference dinner.
Thursday 9/6	8.30-12.00: Holistic Sludge Management Conference. 13.00-17.00: Technical tour: The Swedish tour: Kretseum natural cycle & knowledge centre and long-term experiments with sludge fertilisation. 17.30-19.00: Presentations/address - Mr. O. Ekengren, Executive Vice President IVL, Mrs. F. Renzi, Programme Manager, Delegation of the EU to India. 19.00: Dinner with Indian Delegation, IVL, and project representatives.
Friday 10/6	8.30-10.00: • Waste management presentation, Ronny Arnberg, Director, IVL • Debriefing/way forward (Dr. Karamanos/Dr. Verma). 10.00-14.00: Site visit at SYSAV food waste facility, waste to energy plant and environmental management area.
Saturday 11/6	• Departure of delegation and project team.

4.2 Wastewater Management Conditions in India & Key Workshop Activities

Sewage generation in urban area is approximately 38.000 Million of Liters per Day (MLD), whereas the treatment capacity is around 23.000 MLD out of which operational capacity is only 19.000 MLD through 522 Nos. of operational Sewage Treatment Plants. Tentative sludge generation is 9.000 tonnes per day. The Workshop focused on the following themes, which are related to the Indian scenario:

- Energy recovery by anaerobic digestion process design
- Pathogenic aspects of sludge reuse
- Anaerobic digestion pre-treatment
- Enhancement of anaerobic digestion process
- Incineration of sludge and handling of ashes
- Recycling of material including nutrients
- Influence of microbiology on sludge management
- Sludge management in german and swedish perspectives
- Certification in sludge management
- Life cycle assessment tools for sludge management
- Toxicity aspects in sludge management

5 Solid Waste Management Study Workshop

5.1 General Information

The 1-week Solid Waste Management Study Workshop took place from June 11-18 2016 in Stockholm/Sweden. The purpose of the workshop was to build advanced capacity and develop synergies on solid waste management, as this is one of the key challenges in India and can contribute to the Swachh Bharat mission and the National Action Plan on Climate Change. It has also been important at this stage of the project to develop networks with EU companies, expand the knowledge base, and identify areas of cooperation. Sweden was selected given the country's focus on the waste management hierarchy, utilisation of a range of modern waste management technologies, and the availability of resources from IVL.

Twelve environmental specialists from the Ministry of Urban Development, Central and Maharashtra Pollution Control Boards, North/East/South Delhi Municipal Corporations, Municipal Corporation of Greater Mumbai, Government of NCT of Delhi, Non-Governmental Organisations (i.e., Stree Mukti Sanghatana, Mumbai First) and Timarpur-Okhla Waste Management Company attended the workshop. The Delegation of the European Union to India was represented by Mrs. F. Renzi, Programme Manager, while a number of project team members contributed to the workshops.

The workshop focused on:

1. Interactive sessions with experts from Swedish Ministry of Environment, the Environmental Protection Agency, a number of waste management facilities managers and representatives, etc. on technical, policy and legal issues of solid waste management, including processes, EU, Swedish and Indian regulatory framework, statistics, and challenges.

2. Site visits to biogas, waste to energy, landfill, wastewater 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.

Figure 2 presents the agenda of the study workshop.

Figure 2: Solid Waste Management Study Workshop Agenda

Date	Activity
Saturday 11/6	• Arrival of representatives & project team to Stockholm.
Sunday 12/6	14.45-18:15 • Sustainable Stockholm tour
Monday 13/6	8.45-12.00 • Welcome address, Mr. T. Svedberg, CEO, IVL • Welcome remarks, Mrs. F. Renzi, EU Delegation to India • EU overview & project presentation, Dr. P. Karamanos, EU-India Project • Waste management presentation, Dr. V.K. Verma, EU-India Project • Mrs. Johanna Lissinger Peitz Ministry of Environment • Mr Lars Zetterberg , Climate Expert IVL • Introduction to solid EU waste management, Jan-Olof Sundquist, IVL 13.00-17.00 • Scandinavian Biogas Plant, Bio Waste to Biogas
Tuesday 14/6	9.30-12.00 • Hammarby Sjöstadsverk-Facility for research, development & demonstration of wastewater treatment technologies 13.30-17.00 • Ragnsells Högbytrorp (Cover old landfill, hazardous waste)
Wednesday 15/6	8.30-10.00 • Swedish Environmental Protection Agency (EPA) 10.00-13.00 • Municipality Stockholm, Water/Sewage and Waste Company • Visit Waste 2 Energy plant Högdalen (the biggest in Sweden 800.000 ton/year) 13.00-17.00 • Hammarby Sjostad Glasshouse 1

Thursday 16/6	8.00-13.00
	• Regional Waste Company Sörab
	  ○ Eco park in an old Landfill
	  ○ Recycling Center

Friday 17/6	9.30-15.00 • Summary, debriefing and open discussion about next steps • Sorab recycling center in Stockholm
Saturday 18/6	• Departure of delegation and project team

5.2 Solid Waste Management Conditions in India & Key Workshop Activities

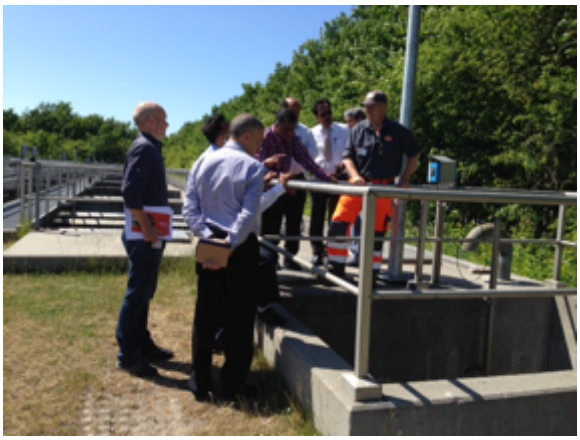
Regarding solid waste management, the Indian scenario is as follows:

- 62 million tonnes of waste are generated annually by a population of 377 million in urban areas of India.
- 75-80% of the solid waste is dumped at the landfills.
- 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 66000 ha.
- In order to treat or process solid waste, there are 535 Nos. of Compost/Vermi-compost plants, 22 Nos. RDF/ Pallets plants, 41 Nos. Bio-gas plants and 13 Nos. Power Plants in country.

The Workshop focused on the following activities/visits, which are related to the Indian scenario:

- Scandinavian Biogas Plant: Process, treatment and compression of biogas to facilitate its usage to run automobiles
- IVL: Membrane bioreactor with state-of-the-art pilot facility for R&D and process optimization.
- Ragnsells Hegbytrop: Best landfill and waste management processes.
- Hogdalen Waste to Energy Plant: Waste management, energy generation and emission and odor management.
- Swedish Environmental Protection Agency: Understanding the state of environment in Sweden and opportunities to explore India-Sweden cooperation for environmental management, mitigation of the impacts of climate change in India, etc.
- Hammerby Sjostad: Smart urban planning including water & sanitation management, effective landuse together with enhanced visual & aesthetic quality
- Regional Management Company (SORAB): Novelty in recycling and smart solid waste management thereby showcasing examples of upcycling and ecopark.

Sludge Management Study Workshop Photos



Solid Waste Management Workshop Photos