2016

Report: Field Trip GS Engineering and Construction, South Korea

21st-22nd November 2016

Prepared by:
Students attend the Solid Waste Course

FACULTY OF CIVIL ENGINEERING,
UiTM , SHAH ALAM
SELANGOR

Introduction

Faculty of Civil Engineering started a research agreement with GS E and C Company since 2015. The research collaboration focuses on the development of biogas from POME and EFB. Through the collaboration with FCE,UiTM Shah Alam, the Company managed to secure research grant from Korean Government for this study. In conjunction with this collaboration, FCE tried to bridge the Company with local industry players in the same field such as WHB, Sime Darby and TH Plantation. With the support from industry, FCE develop the curriculum of Master in Environmental Engineering and special focus is on course of Solid Waste Management.

GS E and C is an international company which was founded in 1969 and has achieved remarkable growth in the field of building, infrastructure, environment and power plant. The company offers a wide variety of environment and solid waste management related technology. This proposal outlines a four-day field trip for Solid Waste Management (ECW752) students, lecturers and representative from industrial player to visit and experience the state-of-art technology in managing the solid waste in a modern world. This field trip will provide new ideas to the problem of solid waste management and the student will apply the knowledge into their case study.

The field trip is collaboration between GS E and C Company, Worldwide Holding Berhad and Faculty of Civil Engineering. This kind of project is to strengthen the smart partnership between university and industry. In addition, students will have unique opportunities to apply their classroom knowledge to actual societal condition and help them to make appropriate and ethical decision.

The students will be asked to prepare a report on how to adapt the new technology into Malaysia condition based on the case study given earlier and to present the idea to the selected panel in solid waste management field.

Objective of field trip

For Students:

The objective of this field trip is to support the learning outcome and the program outcomes of Solid waste management course as below:

Course outcome:

1. Student should be able to propose and evaluate the plans for the collection, transportation, storage, disposal and recovery systems of municipal solid wastes

Program outcomes:

1. Student will learn to make ethical decisions taking into account the impact on society, environment and economy.
2. Student will generate innovative and creative solutions to the solid waste management problems

Impact to Faculty and University

This filed trip shows FCE commitment in developing a new knowledge and technology through smart partnership with industries. FCE will be center of reference in conducting new research in solid waste treatment technology and this symbiosis process between FCE and industry will benefit the students by increasing their level of confident to solve the problem.

Impact to Industry

The Malaysian industry player is still seeking for an appropriate technology for their waste stream treatment. This field trip will be an eye opener to our local industry to benchmark the current technology uses in our country with the performance of new technology from developed world. The idea is not to transfer the technology directly; however, it is more to understand the technology and need to determine the approach on how to adapt the technology under local condition.

For staff UiTM, WHB, CH Consult

1. Attending discussion session to strengthen university and industries smart partnership.
2. Experience and collecting more information on the new cutting-edge technology in waste management and biogas production.

Tentative Program

21/11/2016	
Korea - Malaysia Biomass Energy International Cooperation Conference	
9:00 am	Greeting UiTM, WordWide Holdings and TH plantation, GS E&C Introduce technology GS E&C (**AWCS, Dry fermentation**)
12:00 pm	Lunch
13:30 pm	Site visit in Dongdaemun, Seoul (Food Waste to energy recovery center)
18:00 pm	Dinner with CEO & staff from GS E&C
22/11/2016	
7:00 am	Site visit in Cheongju (**MSW + incineration plant**)
12:00 pm	Lunch
05.00 pm	Site visit to Eunpyeong New-Town Waste Treatment Plant, Eunpyeong

Participants

UiTM's Staff

1. PROF DR AZMI IBRAHIM
2. DR MARFIAH AB.WAHID
3. DR NORASHIKIN AHMAD KAMAL
4. EN.MOHD SHAHIR ABDUL RAHMAN

UiTM's student

1. NUR SABIHA BT MOHD ALUWI
2. FAZRUL AMZAR BIN KHAIRY
3. MUHAMAD HAFIZ BIN AHMAD
4. NUR FATEHA BINTI ASMUNI
5. SITI NURFADHILAH BINTI MOHAMED SABRI
6. WIRA JAYA BIN JAIDIR
7. ZULAKMAR BIN ISMAIL
8. MOHAMAD SHUKRI KAMARUDIN
9. MOHD FAUZAN MOHD HARDI
10. SHAIDATUL AZMA BINTI SULONG

Staff WHB: Puan Mimi

CH Consult: En. Khairi Bin Yeob

SITE VISIT REPORT

Date: 21st November 2016

9.00 am:

All participants gathered at GS Engineering & Construction for the Korea-Malaysia Biomass Energy Workshop. The company is located nearby the Shila Stay hotel where students and lecturers were staying; hence, we just walked to GS E&C and it tooks about 5 minutes of walking. As we arrived there, we were welcomed by Miss Min Jeong KIM or Miss KIM, the Environment Process Engineer and she is also the GS E&C's person in charge for our site visit to Korea.

9.30 am:

The workshop was started by introducing every person from Universiti Teknologi MARA to the GS E&C's team who involved in the conference. After that, we, from Universiti Teknologi MARA stated our purposes of the visit which is to learn and gain knowledge about their solid waste management technology. The workshop was then proceeds with GS E&C Environmental team introducing about their company and how they operated. Their main business is mainly focusing on environmental areas which are water business and waste business. However, our trip is focused only on the waste business as it is related to the Solid Waste Management subject.

12.00 pm:

After the GS E&C team has done introducing their technology and their waste treatment plant; we went for a lunch break at Korea Vegetarian Restaurant.

2.00 pm:

Dr.Marfiah started her presentation about Biomass Energy in Malaysia. The person from Worldwide Landfills SdnBhd, which is Puan Mimi, also presented about Worldwide Landfills and how landfills at Malaysia being operated and taken care of. This meeting is aimed to exchange the ideas of technology between Korea and Malaysia. After the presentation, the workshop was opened for Q&A session from both GS E&C and UiTM.


2016 Korea-Malaysia
Biomass Energy Workshop


KEITI
Environmental Energy Technology International Cooperation Project
2016 Korea-Malaysia
Biomass Energy Workshop

3.15 pm:

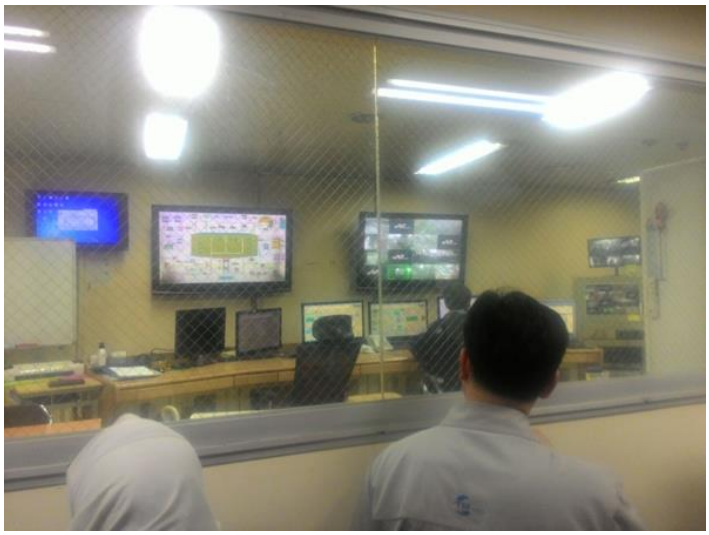
Exactly at 3:15 pm just after we checked in Shilla Stay Hotel, we had a site visit to Dongdaemun Environmental Resources Center which just took about 20 minutes to arrive from our hotel.

As we arrived there, we had been presented a pleasant introduction video and Q&A session which is answered by their person in charge in the facilities. Dongdaemun Environmental Resources Center in Seoul is one of those places where garbage and recyclable materials find another use. It is a comprehensive waste treatment facility that processes different kinds of waste, including general waste, food waste, recyclables, and bulk garbage. Dongdaemun Environmental Resources Center is the only facility that provides one-stop treatment for all types of domestic waste produced by human activities. What can be recycled gets recycled and what needs to be incinerated gets incinerated here. Food waste sent to landfills causes odor as it decomposes, contaminates underground water, and leads to the generation of air pollutants. It is the facility that transforms food waste into a resource and can produce 20.4 megawatts of electricity that can be consumed by 2,500 households each living in a 34-pyeong apartment (1 pyeong is equal to 3.3 square meters) with four family members. The facility processes 98 tons of food waste per day.

Here, food waste gets converted into biogas, a type of clean fuel that can be used as power to heat buildings and even run vehicles. The role of this facility is in line with South Korea's efforts to increase the use of biogas and other clean energy alternatives under the Lee Myung-bak administration that promotes a new development model that emphasizes so-called green growth. Biogas is a by-product of a process called anaerobic digestion (AD). AD is a process where organic matter -- such as food waste -- breaks down in an environment with little or no oxygen, generating a natural gas made up mostly of methane and CO2. It is the exact process, in fact, which goes on in landfills. But there is a difference. Whereas methane can be harmful to the environment in an open setting, such as a landfill, in controlled and closed settings such as a combined heat and power plant, it can be harnessed and converted into biogas, a renewable energy. And that energy can be used to provide heat, light and fuel. At the

center, biogas produced through the process of AD is burned to create electricity. The economic impact of this facility is quite phenomenal. The use of food waste as a resource can yield 600,000 kilowatts of electricity annually and reduces 24,402 tons of CO2, creating an economic impact worth 2.7 billion won (2.5 million U.S. dollars).

We also are brought to their monitoring room where they controlled the extensive air pollution. All aspects of the plants are monitored from the central control room 24hours a day, a week, 365 days a year. The environmental control systems were designed with the new, more stringent, Clean Air Act in mind, and emissions have met the proposed standards without any modification. Facility emissions are continuously monitored and strictly regulated by state and federal agencies. The examples of emissions that filtered by the monitoring room are NOx, Dust, CO, HCl and etc.




Dongdaemun Environmental Resources Center Miniature

Date: 22nd November 2016

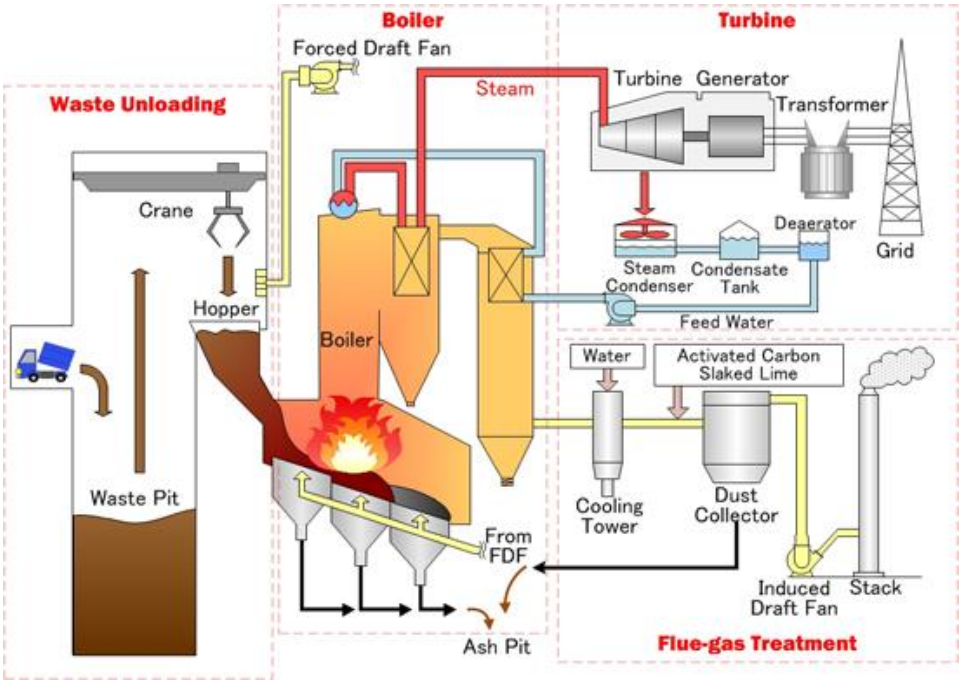
The next day activities continued as we moved to Cheongju Metropolitan Solid Waste Disposal Plant which is located about 115km South East to Seoul City. We depart from our hotel at 9 a.m. The journey took about 2 hours and 30 minutes to reach there by our shuttle bus. This is a very fascinating and impressive WtE Plant in Korea because it is a Stoker Type Incinerator and has equipped with sports facilities such as gym, indoor swimming pool, sauna, badminton court and gateball court. The capacity of the plant is 200t/day and it generates 2.0 kWh of electricity to be sold to client which is Korea Electric Power Corporation. The plant also produces steam heat about 14Gcal/hr (Korea District Heating Corporation and Supplying Hot Water), 170ton/day MSW collected, and large volume of waste recorded are 30ton/day. The plants are worth for $3.74 Mil/year.

GS E&C has Total Solution for waste management. Waste is recycled at all processes, converted to energy at waste treatment plant and stabilized at sanitary landfill. Waste cycle processes are environmental friendly, energy efficient city infrastructure. To deal with the inadequate capacity of existing waste incinerators and to prepare for the era of a 1million Cheongju population, there are plans to construct regional incinerators of the

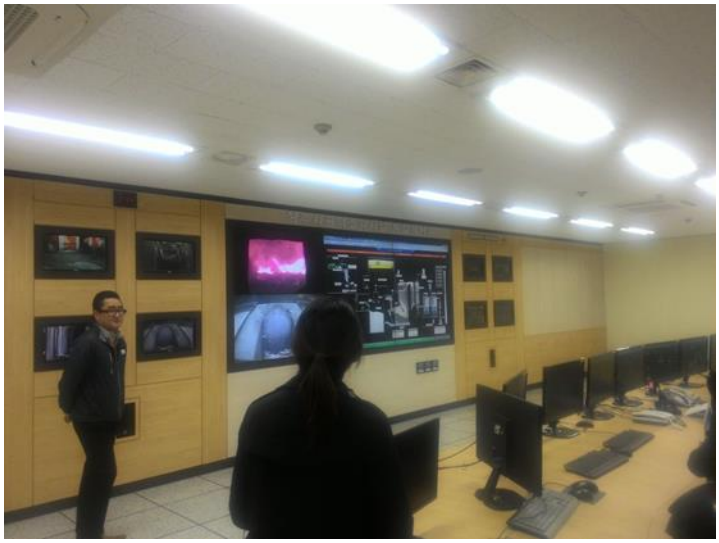
highest level and introduce excellent local and overseas technology to effectively handle household and large wastes generated by the entire region. Also, to address the shortage of waste landfill sites and to expand the safe treatment base for household waste, a green city that aims to minimize the ever-growing problem of severe city population is to be created.

View from outside of the Cheongju City WtE plant

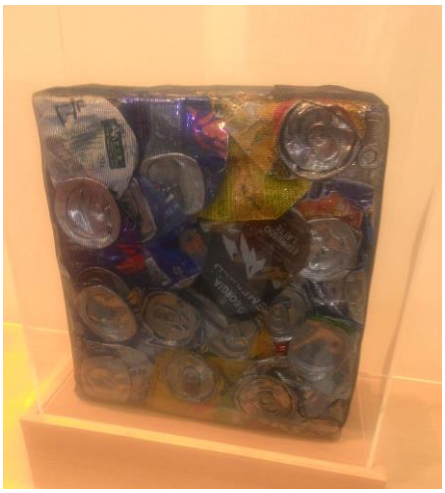
View of the first and second plant. The first plant area was about 72, 601 km² whereas the second plant measured about 22, 847 km². So, the total area to built these two plants are approximately 95,448 km².



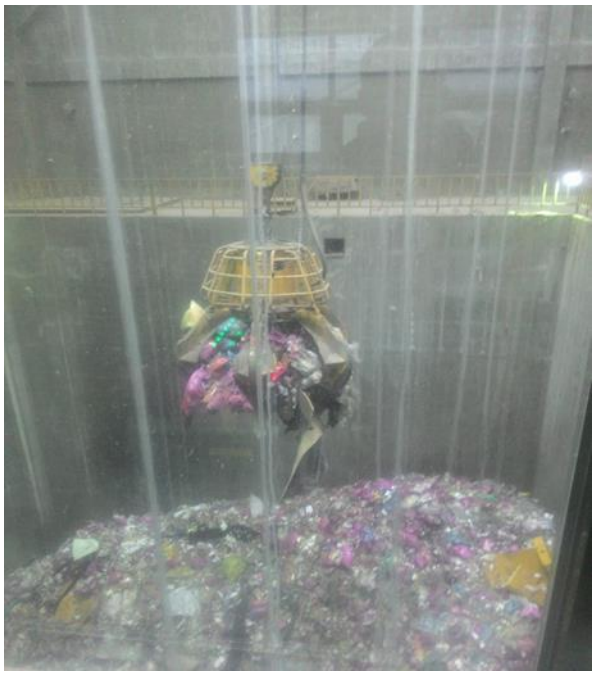
Process Flow of the plant begins from the waste pit till the end of process in the chimney.



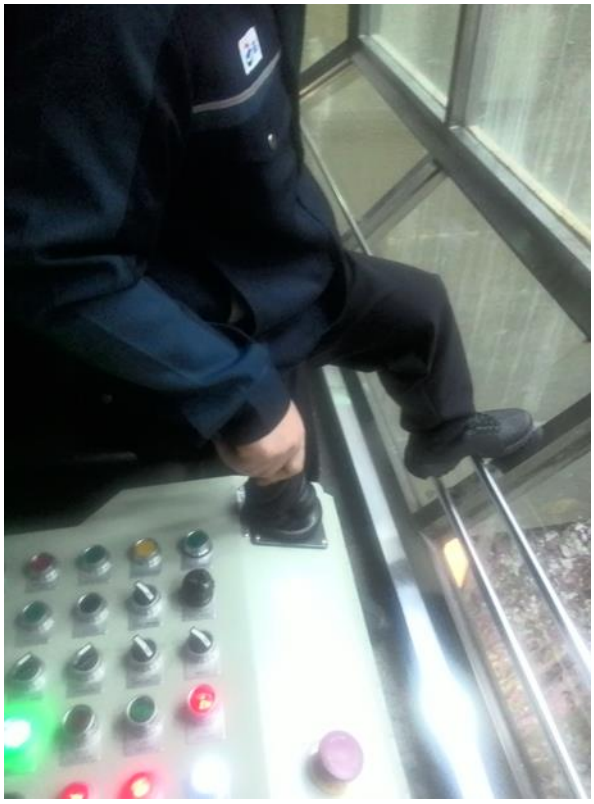
View inside the monitoring room.



Examples of recyclable waste after being compacted by compactor. From left side tin, paper and plastic (bottle) materials which had been compacted.



The view of waste storage chamber from inside crane control room. We are able to watch how the crane works to haul and put all the larger waste inside the crusher and then grab it to be put into hooper.



One person need to in charge from inside the crane control room.

2.30 pm:

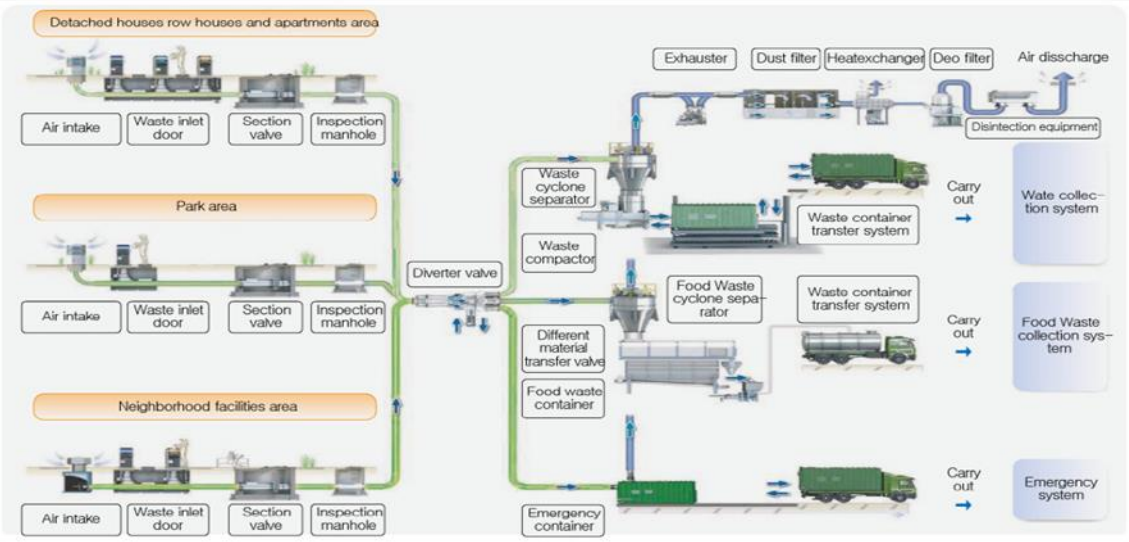
We moved back to Seoul region for our last site visit in Eunpyeong New-Town Waste Treatment Plant which took about 3hours ETA from Cheongju. This is the most interesting part of all, because the technology is very futuristic due to its Automated Waste Collection System (AWCS). An automated waste collection system, also known as pneumatic refuse collection, or automated vacuum collection (AVAC), transports waste at high speed through underground pneumatic tubes to a collection station where it is compacted and sealed in containers. When the container is full, it is transported away and emptied. The system helps facilitate separation and recycling of waste.

The process begins with the deposit of trash into intake hatches, called portholes, which may be specialized for waste, recycling, or compost. Portholes are located in public areas and on private property where the owner has opted in. The waste is then pulled through an underground pipeline by air pressure difference created by large industrial fans, in response to porthole sensors that indicate when the trash needs to be emptied and help ensure that only one kind of waste material is travelling through the pipe at a time. The pipelines converge on a central processing facility that uses automated software to direct the waste to the proper container, from there to be trucked to its final location, such as a landfill or composting plant.

The system: The vacuum waste collection system in Eunpyeong Seoul New Town is combined with an incineration facility for extra effective waste treatment. The green amenity is the main concept of this development, which is one of the reasons for choosing an Envac system to handle the waste. The catch phrase is “The Pride of Seoul”. The area is planned by Seoul Metropolitan Government. The automated waste collection system serves 15,500 households. A new outdoor inlet that identifies bags authorized by the local governement is introduced for the first time in Korea. The tag reader is visible on the right side of the inlet.

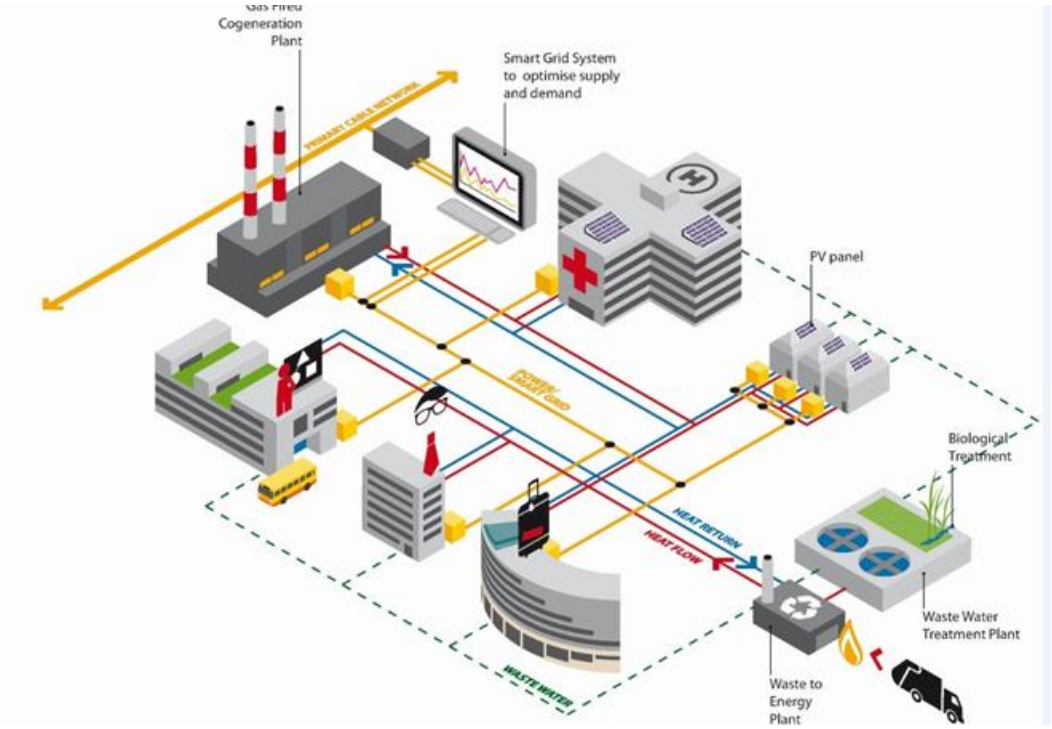
Eunpyeong New-Town Waste treatment Plant

- Area : 3,495,248 m², Expect Population : 15,200 people
- Waste Collection Capacity : 55.25 ton/day
- Pipe Line : 50.2 km (500A+600A)



Automated Waste Collection System

Process flow of AWCS



An environmental-friendly AWCS for Building/Apartment

Eunpyeong Seoul New Town, Seoul, Korea

Basic project information

Country	Korea
City	Seoul
Project startup	2006
In operation since	2010
Project completed	2010

Basic system data

Type of system	Stationary Vacuum System
System subtype	SVS 500
Application area	Residential area
Design capacity	20 tons per day
Area size	3,492,000m2
Number of fractions	2
Number of inlets	380
Total metres of pipe	29100
Type of waste	General waste / Rest, Food/Organic waste

Conclusion

Many new technologies had been introduced to us beyond our imagination. Hence, some of the technology can be transferred to our country in order to improve the solid waste management system. At the same time, we can reduce our dependent on the landfill. Many effort need to take in order to educate peoples in order to accept the technologies. Students should be given more opportunities to visit and look at the solid waste management system in a well developed country.