2. Collection and Transportation

In this section you will find examples of practices and technologies that ease the process of collecting different types of wastes and transporting them to the corresponding disposal sites. The efficiency and effectiveness of waste collection and transportation ensures the **minimization of the negative impacts of the collected waste in the communities that it traverses**.

2. Collection and Transportation

2-1. Door-to-Door Collection

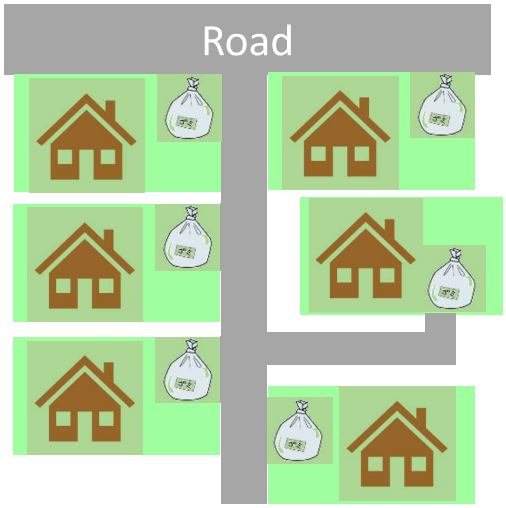
Japan and other countries

Outline

- Residents are instructed to put out their waste on the property facing the street. Unsorted waste is not collected, so each person is expected to take responsibility for the segregation of their waste.
- It takes time to collect waste from a door-to-door collection, but this increases the accountability of households in the wastes they produce, and overall minimizes instances of improper waste disposal.

Good Practice Point

- Residents are more accountable to the wastes they produce and discourages improper waste disposal.
- Stray animals like birds and dogs, are less likely to mess the wastes left out since residents look after their bins until they are collected.
- Waste generators are more aware of their waste production and and the system overall leads to the beautification of the town.



Dispose of waste on your property facing the road

before-and-after photos of door-to-door collection

References

- Musashino City, Tokyo [online] Available at: http://www.city.musashino.lg.jp.e.ad.hp.transer.com/kurashi_guide/gomi_kankyou_eisei/gomi_dashikata/1004835.html

2. Collection and Transportation

2-2. Food Waste Truck Program

Marikina City, Philippines

Target waste

Food waste

Outline

- Food wastes collected from restaurants and food stalls and are being converted into fertilizers to be used for the city's urban garden.
- Commercial facilities generate a large amount of food waste, so it is easier to separate and collect it.
- Collection trucks are specialized for collecting food waste with a stainless-steel interior to prevent rusting and a sealed container to prevent odor from escaping. Truck cost is P2 million ($45,000).

Good Practice Point

- Marikina City generates a lot of food waste from its restaurants and marketplaces. Instead of dumping the generated kitchen waste in landfills, they are collected separately to be used as fertilizers. It saves the LGU money too by eliminating the need for huge trucks for waste collection.

Food waste trucks used in hauling food and kitchen waste in Marikina City

References

- National Solid Waste Management Status Report (2008-2018) by EMB-DENR [online] Available at: https://www.rappler.com/nation/84801-marikina-food-waste-trucks

2. Collection and Transportation

2-3. Transfer Station -1

Japan and other countries

Outline

- A transfer station is facility that efficiently compresses, transfers garbage collected by small vehicles at bases, and transports them by large vehicles.
- Installation of these facilities requires capital investment including the procurement of hauling trucks.

Good Practice Point

- This is effective in cases where the transportation distance from the collection area to the intermediate treatment facility and landfill is long.
- Alternatively, it is possible to reduce the number of trips and improve efficiency by transferring waste loaded on small vehicles to large vehicles. This is effective for cities that have areas where only small vehicles are allowed to pass.

Waste Transfer Station at Kuala Lumpur, Malaysia employing Japanese technologies

Waste Transfer Station at Xian, China employing Japanese technologies

References

- ShinMaywa Industries, Ltd. Refuse Transfer Station System. [online] Available at: https://www.shinmaywa.co.jp/environment/english/products/index.html#a-1

2. Collection and Transportation

2-4. Transfer Station -2

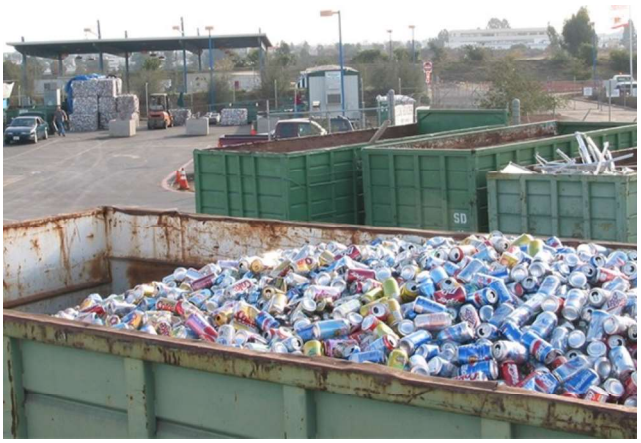
Seattle and San Diego, USA

Outline

- A transfer station is a facility employed when the waste disposal unit is remote to the collection area.
- These facilities are used instead to pool wastes to minimize the traffic and air pollution impacts of hauling wastes to landfill sites.

Good Practice Point

- The waste is brought to transfer stations with 40 yd^3 roll-off bins, which are then hauled to the disposal sites
- In this case, residents can directly bring the waste to the transfer station.



Hauled wastes at Miramar Landfill, San Diego

Seattle North Transfer Station

References

- Sloan W. (2018) Seattle's North Transfer Station Focuses on Community Engagement, Safety [online] Available at: https://www.waste360.com/transfer-stations/seattle-s-north-transfer-station-focuses-community-engagement-safety

2. Collection and Transportation

2-5. Truck Routing

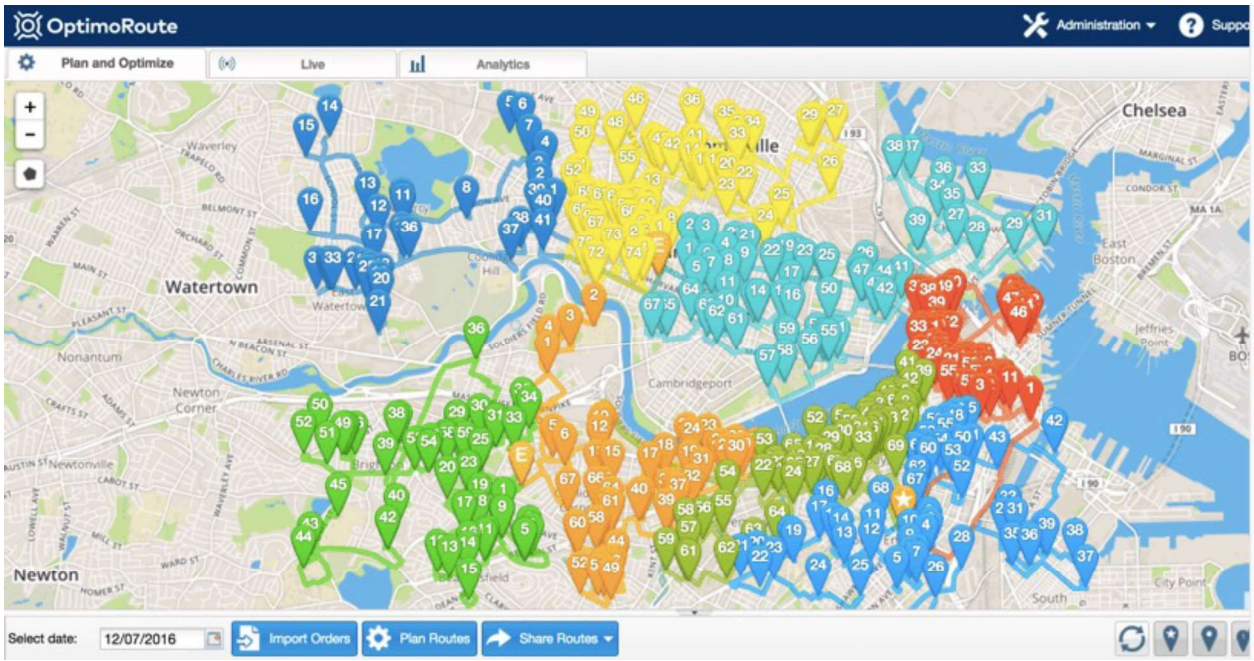
City of Charlotte, North Carolina

Outline

- Routing is planned to avoid or minimize deadheading, or the instance of passing by a collection point more than once in the route. Busy and narrow corridors are also avoided to minimize risks and traffic congestion.

Good Practice Point

- Formulation of the optimal route minimizes transportation costs and improves the speed of waste collection. Considerations include one-way roads, dead-ends, busy roads and intersections, turnings and other pertinent information.
- Movement of hauling trucks can be monitored by residents through a mobile app.



Optimoroute sample routing scheme

References

- Sulemana A, et. Al (2018) Optimal Routing of Solid Waste Collection Trucks: A Review of Methods [online] Available at: https://www.researchgate.net/publication/328174888_Optimal_Routing_of_Solid_Waste_Collection_Trucks_A_Review_of_Methods
- OptimoRoute. Automated Route Planning of Waste Collection Routes [online] Available at: https://optimoroute.com/business-type/waste-collection/

2. Collection and Transportation

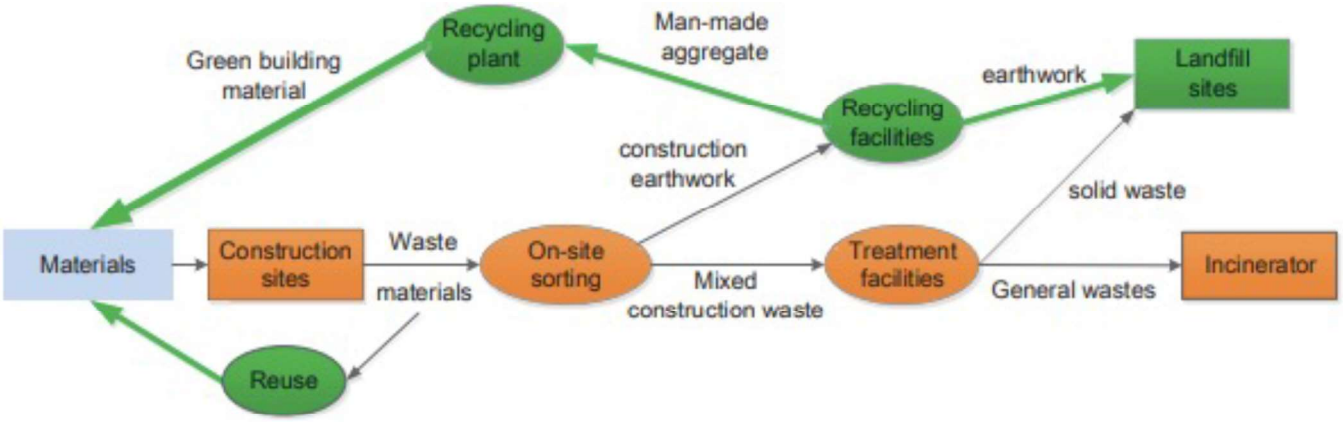
2-6. Equipping Transporting Vehicles with GPS
Taipei, Taiwan and other countries

Outline

- Taipei's Industrial Waste Control Center (IWCC) has equipped transporting vehicles hauling industrial wastes including construction waste and liquid hazardous waste with Global Positioning System (GPS) to keep track of illegal or improper waste disposal behaviors.

Good Practice Point

- Using information systems and GPS, the center analyzed the data of industrial wastes reported online and the shipping routes of the waste to find possible violations.



Flow chart of waste disposal tracking and management

References

- Houng H. et. Al. Policies and Measures of Waste Disposal and Treatment in Taiwan [online] Available at: https://www.pecc.org/resources/infrastructure-1/1246-towards-zero-waste-society-new-management-policies-for-solid-waste-disposal-in-chinese-taipei-1/file
- Ying-Ying Lai et. al (2015) Management and Recycling of Construction Waste in Taiwan [online] Available at: https://www.sciencedirect.com/science/article/pii/S1878029616301669/pdf?md5=9fe001bdc8600067891232e2061a85c6&pid=1-s2.0-S1878029616301669-main.pdf

2. Collection and Transportation

2-7. Model Country on waste collection and transportation

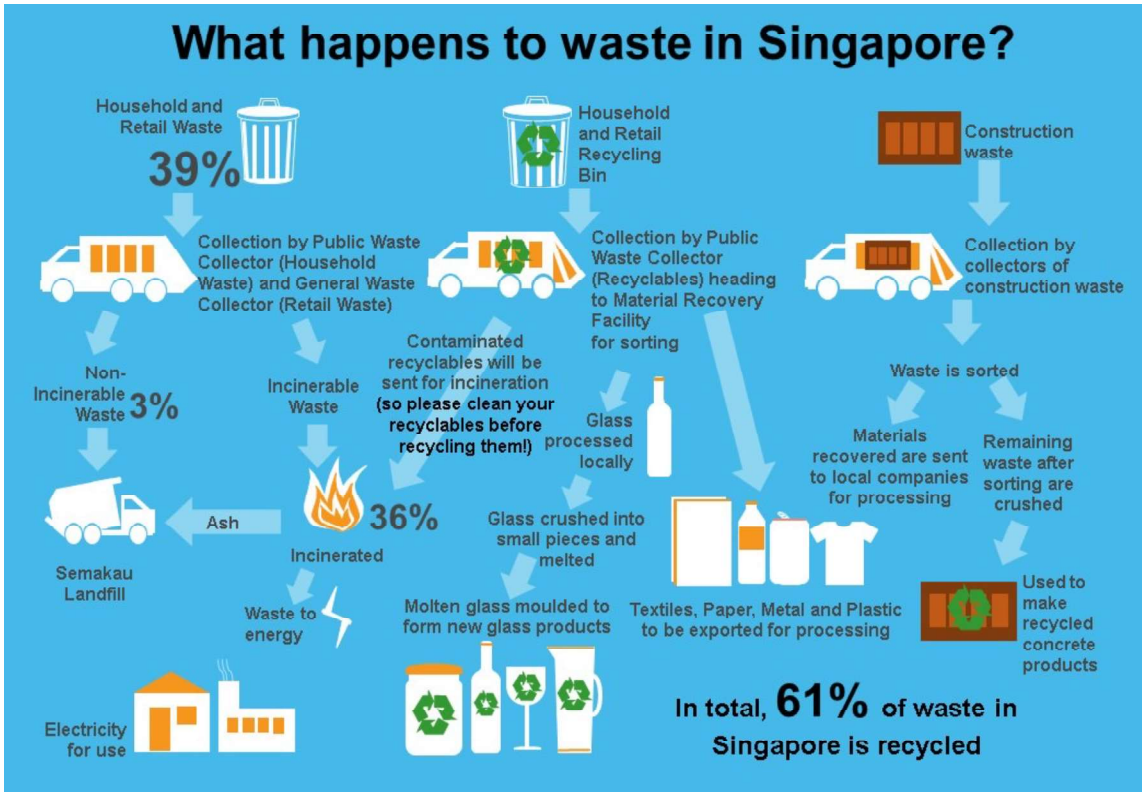
Singapore

Outline

- In Singapore, residents and establishments practice waste segregation, which makes it easier for their licensed and well-trained waste collectors to handle and collect wastes.
- Singapore also puts importance on intensive training of their waste collections to ensure that protocols are strictly observed.

Good Practice Point

- Waste segregation is well-observed at source which eases the process of collection. Waste collectors undergo official trainings and require a license before they can become eligible for collecting a specific type of waste.



Waste collection in Singapore

References

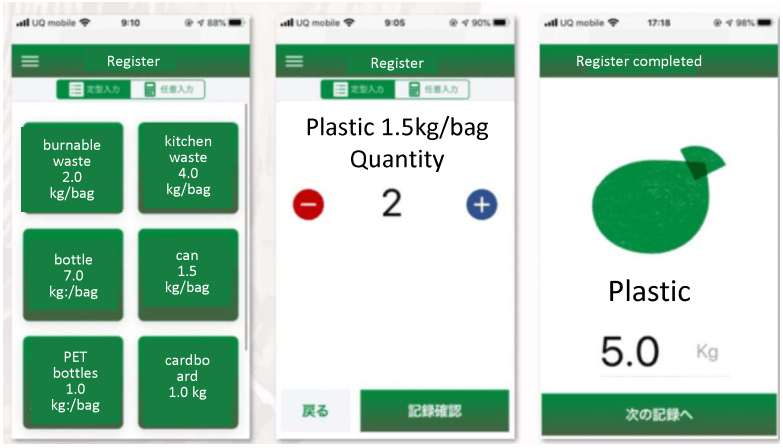
- National Environment Agency (2022) Waste Management Infrastructure [online[Available at: https://www.nea.gov.sg/our-services/waste-management/3r-programmes-and-resources/waste-management-infrastructure/solid-waste-management-infrastructure

2. Collection and Transportation

2-8. Cloud-based waste collection route optimization app
RECOTECH inc. in Japan

Outline

- GOMiCO is a web application where waste generators can record information such as type, amount, and location of their waste.
- The Material Pool System (MPS) is a cloud platform that aggregates the information recorded by GOMiCO. From the information recorded in GOMiCO, it not only displays information such as type, amount, and generation time of recycled resources, but also maps its source.



Record input screen

Activity confirmation screen

Good Practice Point

- GoMiCO makes it possible not only to easily manage the measurement of waste, but also to process the accumulated data into graphs and summary tables. It is also useful for studying measures to control the generation of waste and preparing reports.

References

- RECOTECH Inc. What We Do[online] Available at: https://recotech.co.jp/whatwedo/

2. Collection and Transportation

2-9. Station collection for recyclable waste
Japan and other countries

Outline

- Residents decide collection points within the community where wastes are disposed, and different types of wastes are collected on designated days of the week. Unsorted waste is not collected.
- For recyclable waste, separation boxes need to be installed every time.
- Collectors collect in the morning or late at night to avoid traffic jams.

Good Practice Point

- By setting the collection point, waste can be collected in a shorter time and cost can be saved.
- Since unsorted waste is not collected and are left in the collection point, neighborhoods are more aware of instances of improper segregation and disposal which ultimately minimizes such occurrences.

Bins, cans and plastic bottles are separately collected

References

- Kita City [online] Avaitable at: http://www.trans2.city.kita.tokyo.jp/LUCKITA/ns/tl.cgi/http%3a//www.city.kita.tokyo.jp/kitakuseiso/kurashi/gomi/bunbetsu/shigen/bin.html?SLANG=ja&TLANG=en&XMODE=0&XPARAM=keyword,&XCHARSET=utf-8&XPORG=e3839ae38383e38388e3839ce38388e383ab,&XJSID=0
- Tokonami, M (2019) Munakata City Why is garbage collected early in the morning? Finish work in the morning and pay attention to hygiene [online] Available at: https://www.nishinippon.co.jp/item/n/549723/

2. Collection and Transportation

2-10. Community-based of Mini Recycling Centers

Bristol, UK

Target waste

Recyclable waste

Outline

- Bristol has mini recycling centers which are made up of a set of large bins where cans, cardboard, food waste, glass, paper and plastic can be recycled. They are installed at households of multiple occupancy (HMOs), and residents can request for one using their website.

Good Practice Point

- The mini recycling centers provide an easy and efficient way for residents to store their recyclables for collection. This allotted space also ensures that there is plenty of space for the recyclable, to avoid littering and encourage proper waste segregation.

Mini Recycling Center

References

- Mini recycling centers for blocks or flats (Bristol City Council) [online] Available at: https://www.bristol.gov.uk/bins-recycling/recycling-in-flats-mini-recycling-centres

2. Collection and Transportation

2-11. Recycling Drop Off Sites

Bristol, UK

Target waste

Recyclables, household hazardous waste

Outline

- Recycling Drop Off Sites is open for the residents, and the facility takes all typical household hazardous waste such as thermometers, liquids, chemicals, petrol, medicines, paints, flares etc.

Good Practice Point

- These collection stations provide a designated place for waste drop off and collection and minimizes mismanagement of waste and unnecessary littering.
- It also makes it safer and easier for garbage collectors to round up wastes, particularly household hazardous wastes.

Recycling drop off sites (Household Reuse and Recycling Centre)

References

- Bristol City Coucil. Hazardous Household Waste [online] Available at: https://www.bristol.gov.uk/bins-recycling/hazardous-household-waste
- Quinault C. (2020) Bristol Mayor opens 'transformed' HWRC [online] Available at: https://www.letsrecycle.com/news/bristol-mayor-opens-transformed-recycling-centre/

2. Collection and Transportation

2-12. Group Collection of Recyclable Waste
Japan and other countries

Target waste

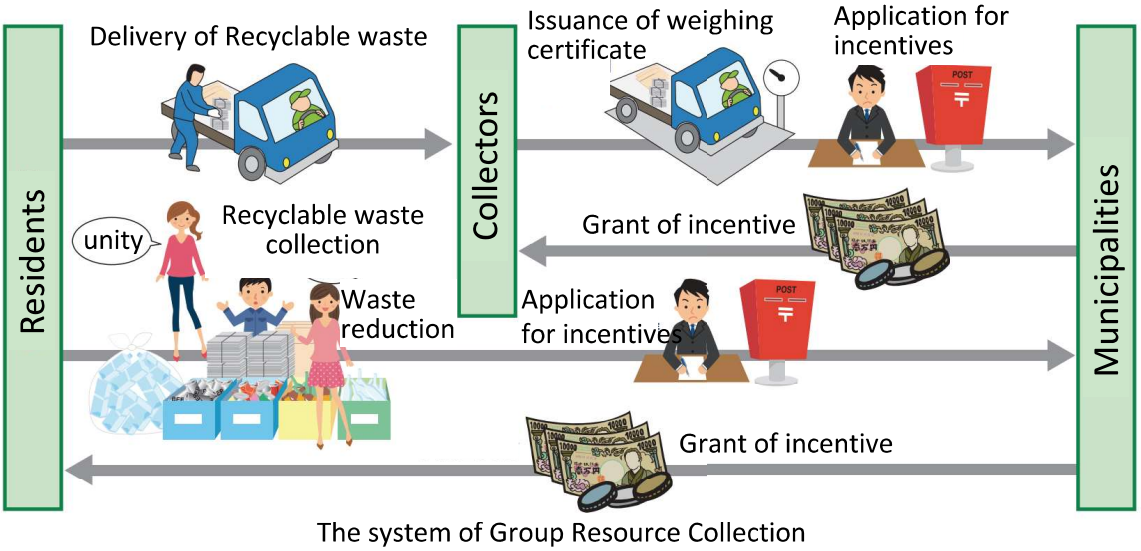
Recyclable waste
Wastepaper [newspaper, magazine and corrugated cardboard], the milk pack, the cloth kinds, the steel can, the aluminum can and the bottle.

Outline

- Registered residential groups and traders facilitate the collection of resources (paper, cloth, metal, bottles). In return, the city provides a subsidy corresponding to the volume collected.
- Their system involves implementation of designated spaces for waste disposal to ease the process of collection.
- These collectors need to go through necessary procedures such as securing contract with supplier and registering to the city.
- This system depends on the independence of residents.

Good Practice Point

- Subsidy provided in the group collection is more cost-efficient.
- Incentive money can be used effectively as an activity fee for registered organizations.



The system of Group Resource Collection

References

- Kita City [online] Avaitable at: http://www.trans2.city.kita.tokyo.jp/LUCKITA/ns/tl.cgi/http%3a//www.city.kita.tokyo.jp/kitakuseiso/kurashi/gomi/bunbetsu/shigen/bin.html?SLANG=ja&TLANG=en&XMODE=0&XPARAM=keyword,&XCHARSET=utf-8&XPORG=e3839ae38383e38388e3839ce38388e383ab,&XJSID=0

2. Collection and Transportation

2-13. Kitchen waste collection

Shibushi City, Japan

Target waste

Kitchen waste

Outline

- In Shibushi City, Kagoshima Prefecture, food waste is collected separately.
- Residents put kitchen waste in a draining bucket at each household and discharge them in a dedicated container on the collection day.
- Collected food waste is processed and sold or distributed to the residents as compost.
- In this city, the draining buckets are purchased by the residents, but there is also an option to distribute them through the local government.

Good Practice Point

- Since these dedicated containers are also used by the entire neighborhood, residents make an effort to keep them free of contaminants other than food waste.

Kitchen waste collection system in Shibushi City

References

- Shibushi City [online] Available at: https://www-city-shibushi-lg-jp.translate.goog/soshiki/6/1817.html?_x_tr_sl=ja&_x_tr_tl=en&_x_tr_hl=ja&_x_tr_pto=wapp
- Shibushi City [online] Available at: https://www-city-shibushi-lg-jp.translate.goog/soshiki/6/1826.html?_x_tr_sl=ja&_x_tr_tl=en&_x_tr_hl=ja&_x_tr_pto=wapp

2. Collection and Transportation

2-14. High-tech food waste recycling machines
Seoul City, South Korea

Target waste

Organic wastes

Outline

- A total of 6,000 automated bins equipped with scales and Radio Frequency Identification (RFID) weigh food waste as it is deposited and charge residents using an ID card.
- Waste collected using the biodegradable bag scheme is squeezed at the processing plant to remove moisture, which is used to create biogas and bio oil. Dry waste is turned into fertilizer that is, in turn, helping to drive the country's growing urban farm movement.

Good Practice Point

- The pay-as-you-recycle machines have reduced food waste in the city by 47,000 tons in six years, according to their City Officials.
- Residents are urged to reduce the weight of the waste they deposit by removing moisture first. Not only does this cut the charges they pay - food waste is around 80% moisture - but it also saved the city $8.4 million in collection charges over the same period.

Automated bins equipped with scales and RFID

Consumer uses tap card to activate automated bins

References

- GAIA Asia Pacific (2019) Citizens at the Center: Seoul's Journey to Zero Waste [online] Available at: https://zerowasteworld.org/wp-content/uploads/Korea.pdf
- Broom D. (2019) South Korea once recycled 2% of its food waste. Now it recycles 95% [online] Available at: https://www.weforum.org/agenda/2019/04/south-korea-recycling-food-waste/

2. Collection and Transportation

2-15. Interactive segregated waste collection
Brgy. San Ignacio, Municipality of Manay, Davao Oriental, Philippines

Target waste

Recyclable wastes, particularly plastic waste

Implementation entity

Sangguniang Kabataan Council (Youth Council)

Outline

- In the "Shoot the Kalat" program, metal waste bins are installed in designated points in the barangay to have a convenient place to throw plastic waste after seeing that most of the barangay litter improperly disposed of are plastic materials.

Good Practice Point

- Accessibility of waste bins make it more likely for residents to dispose of the wastes properly. This goes hand in hand with the distribution of green waste bins to facilitate proper waste segregation in the barangays, all aligned in their theme "Be a part of the solution, not part of the pollution"

Metal waste bins for plastic collection

Distribution of green waste bins for residual waste collection

References

- Sangguniang Kabataan of Brgy. San Ignacio (2021) Shoot the Kalat Trash Bin Project [online] Available at: https://www.facebook.com/page/893963557476890/search/?q=shoot%20the%20kalat

3. Intermediate treatment Reduce, Reuse, Recycle (3R)

Intermediate treatment and 3R practices in this section include waste diversion efforts that minimize wastes that would otherwise end up in landfill sites. The National Solid Waste Management Commission (NSWMC), through the waste hierarchy, emphasizes the value in taking 3R measures to minimize the resources needed to accommodate the waste in their final disposal.

<u>Recycling of organic waste</u>

3-1. Black Soldier Fly (BSF)
3-2. Bokashi composting of food waste from restaurants and hotels
3-3. Utilizing rice husks
3-4. Food Waste Recycling
3-5. Waste biomass torrefaction
3-6. Organic Waste Treatment System
3-7. Disassembled food waste disposer "Shorio“

<u>Promotion of recycling</u>

3-8. Ecobrick Movement
3-9. Basuranihan Project
3-10. WISHCRAFT - We Integrate Scholarship with the Collection of Recyclables and Frequently Generated Trash-
3-11. Plastic for Rice Program
3-12. Recycling Drop off Sites, IEC, Promotion of recycle
3-13. Refuse derived paper and plastics densified Fuel
3-14. Waste bank (Bank Sampah)
3-15. Act on Promoting Green Procurement
3-16. Smart Mobile Waste Transfer Centers
3-17. Pant System
3-18. Recycle at H&M

<u>Promotion of reuse</u>

3-19. Tax Break for Repair -1
3-20. Tax Break for Repair -2
3-21. Resource Recycling and Reuse Act

<u>Promotion of appropriate waste management</u>

3-22. District Model of Waste as a Resource
3-23. Model Ward Initiative

3. Intermediate treatment /3R

3-1. Recycles of organic waste
Black Soldier Fly (BSF)
Sidoarjo Regency, Indonesia

Target waste

Organic Waste

Implementation entity

Sidoarjo Regency

Outline

- In fulfillment of a Research and Development project funded by the Swiss State Secretariat for Economic Affairs (SECO), implemented at Sidoarjo, black soldier fly larvae are used for compost production and animal feed production.
- The facility is able to process 2 tons per day of organic waste. Grown larvae are harvested and processed to animal feed (fish and poultry) while the residue is used as compost.

Good Practice Point

- Shorter production time from traditional systems; Selling BSF is more beneficial than selling compost, and provides a big opportunity in animal feed market

Organic waste recycling facility in Sidoarjo

Black soldier fly composting

Items	Project information
Commencement date	2013
Capacity	N/A
Target area	634.38 km^2

References

- Eawag Aquatic Research. Black Soldier Fly Biowaste Processing. [online] Available at: https://www.eawag.ch/en/department/sandec/projects/mswm/black-soldier-fly-biowaste-processing/
- Eawag Aquatic Research. From Organic Waste to Recycling for Development Upcycling of Urban Organic Solid Waste in Indonesia [online] Available at: https://www.eawag.ch/en/department/sandec/projects/mswm/forward-from-organic-waste-to-recycling-for-development/

3. Intermediate treatment /3R

3-2. Recycles of organic waste
Bokashi composting of food waste from restaurants and hotels
Raub District, Malaysia

Target waste

Food waste

Implementation entity

Raub District

Outline

- Backed by JICA and Solid Waste Corporation Management (SWCorp), establishments were trained in managing kitchen waste thru the Bokashi method.
- The program aims to increase recycling rate, by turning food waste into fertilizer and divert waste from the Cheroh landfill near the hilltop resort of Fraser's Hill.

Good Practice Point

- By providing kits and proper education to restaurants and other establishments, the program was able to process about 9000kg of food waste from commercial establishments, producing 200kg of fertilizer in 2016 alone.

Bokashi composting kit

Fraser's Hill Food Waste Compost Centre

Items	Project information
Commencement date	1990s
Capacity	N/A
Target area	2,829 km^2

References

- The Star Malaysia (2016) Zero waste at Fraser's Hill [online] Available at: https://www.thestar.com.my/news/nation/2016/05/03/zero-waste-at-frasers-hill-resort-aims-to-increase-recycling-rate-and-turn-food-waste-into-fertilise/
- Ichimura A. (2019) How bokashi composting can redirect food waste away from landfills [online] Available at: https://fnbreport.ph/9998/how-bokashi-composting-can-redirect-food-waste-away-from-landfills/

3. Intermediate treatment /3R

3-3. Recycles of organic waste Utilizing rice husks

Cambodia

Target waste

Organic waste
(rice husks)

Implementation entity

SNV
(NGO in Cambodia)

Outline

- Being a major rice producer, Cambodia recognized the untapped potential of rice husks being produced that only end up in landfills. The country put up waste-to-energy (WTE) rice milling technologies based on efficient rice husk gasifiers. This initiative also encouraged local manufacturers to produce the gasifiers, further pushing technology to support the policy.

Good Practice Point

- Understanding the primary waste produced, and recycling of rice husks paved the way for new opportunities, where about 4-5 local SMEs were tapped to produce the RHGs for 120 rice millers to make use of husks that have otherwise went to landfill sites.

EU-Switch Asia Funded Project

600kW rice husk gasifier

Items	Project information
Commencement date	2013
Capacity	N/A
Target area	N/A

References

- Fondation Ensemble (2016) Waste to Energy for the Rice Milling Sector in Cambodia [online] Available at: https://www.fondationensemble.org/en/projet/waste-to-energy-for-the-rice-milling-sector-in-cambodia/
- Barbian D. (2016) Waste to Energy (WtE) in Rice Milling Sector [online] Available at: https://www.switch-asia.eu/project/wte-in-rice-milling-sector/

3. Intermediate treatment /3R

3-4. Recycles of organic waste
Food Waste Recycling

Taipei, Taiwan

Target waste

Food Waste

Implementation entity

Taipei City

Outline

- Part of the "Zero Landfill" initiative of Taipei, the program was implemented to divert some waste, particularly food waste, and minimize the wastes to be sent to landfill facilities.

Good Practice Point

- Food and kitchen wastes from households and restaurants are collected separately to be used as animal feed and as compost material.

Food waste collection; Wall Street Journal

Taipei Food waste collection process

Items	Project information
Commencement date	1997
Capacity	590,000 tons (2019)
Target area	272.14 km^2

References

- Houng H. et. al. Policies and Measures of Waste Disposal and Treatment in Taiwan [online] Available at: https://www.pecc.org/resources/infrastructure-1/1246-towards-zero-waste-society-new-management-policies-for-solid-waste-disposal-in-chinese-taipei-1/file
- Ecologic Institute (2017) Waste charging system in Taipei [online] Available at: https://pocacito.eu/sites/default/files/WasteCharging_Taipei.pdf
- Chen K. (2016) Taiwan: The World's Geniuses of Garbage Disposal [online] Available at: https://www.wsj.com/articles/taiwan-the-worlds-geniuses-of-garbage-disposal-1463519134

3. Intermediate treatment /3R

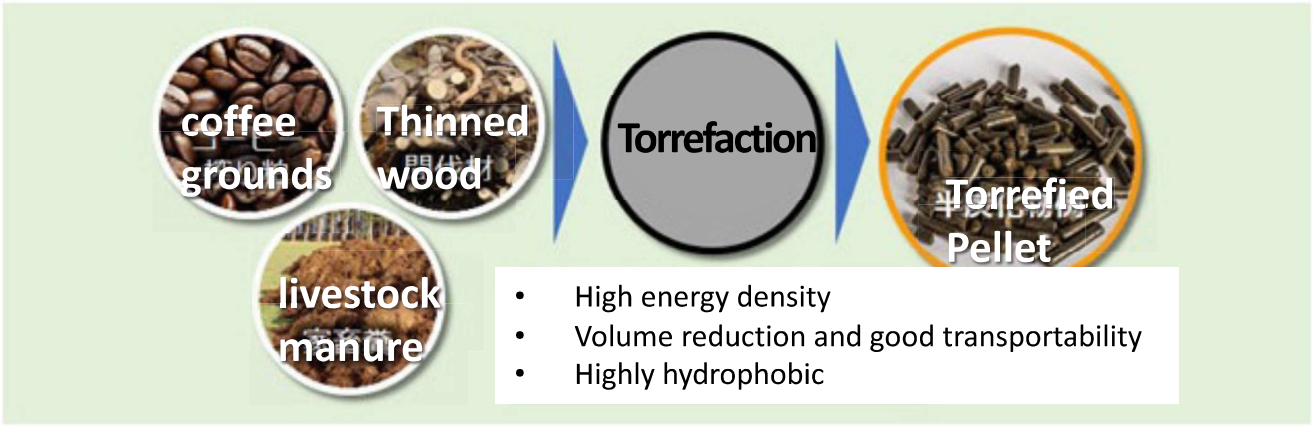
3-5. Recycles of organic waste
Waste biomass torrefaction
Finetech Co. Ltd. In Japan

Outline

- Thinned wood, food residue (coffee grounds, etc.) and livestock manure (especially herbivorous livestock), which are considered to be unused biomass, are used as raw materials for torrefaction.
- Produced torrefaction pellets are hydrophobic, which makes it easier to handle, transport, and use.

Good Practice Point

- Waste volume is reduced by torrefaction while retaining as much energy as possible. Depending on the water content, the volume can be reduced to about two-thirds to one-third before torrefaction. Since torrefaction pellets have a high energy density per volume, they are valuable as auxiliary fuels for carbon dioxide reduction in coal co-firing boilers



Process of torrefaction

References

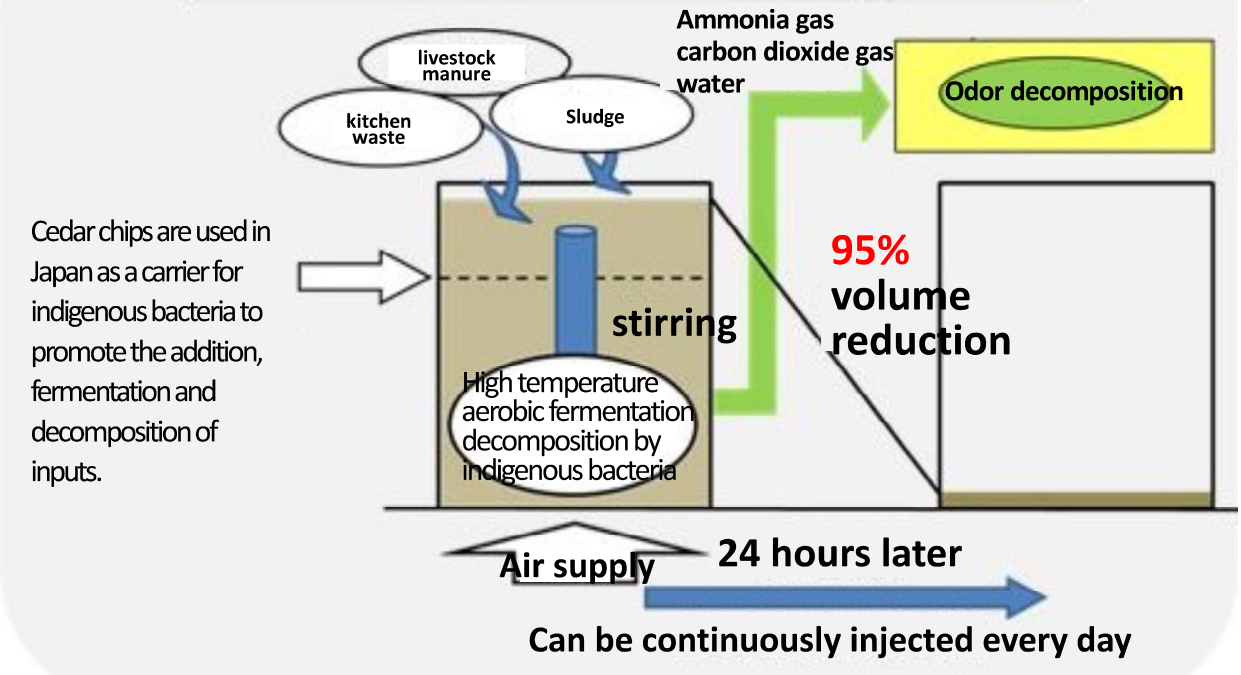
- Finetech CO.,LTD [online] Available at: https://finetech.co.jp/

3. Intermediate treatment /3R

3-6. Recycles of organic waste
Organic Waste Treatment System
Mikuniya Corporation in Japan

Outline

- A technology that promotes high-temperature aerobic fermentation decomposition by indigenous bacteria and reduces the volume of waste by appropriately applying and adjusting enzymes, heat, moisture, and pH level.



Good Practice Point

- No special bacterial cells are required.
- Utilizing cedar chips with a porous structure, creates an environment where many microorganisms can live.
- The temperature and moisture environment in which the decomposition of organic matter by microorganisms is most activated are controlled in the equipment.
- Since the cedar chips are replaced about once every six months, the maintenance cost is low.
- The scale of the equipment can be provided from 25 kilograms to 1 ton per day.

References

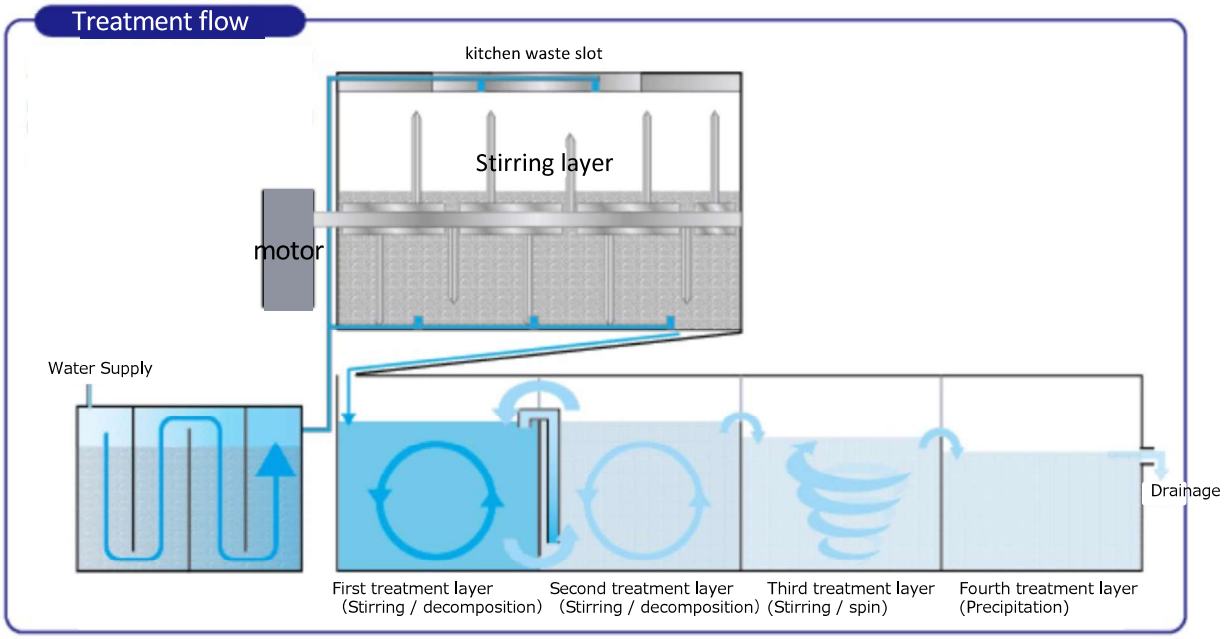
- United Nations Industrial Development Organization. "Mishimax": A Volume Reduction System for Organic Waste Treatment [online] Available at: http://www.unido.or.jp/en/technology_db/5022/

3. Intermediate treatment /3R

3-7. Recycles of organic waste
Disassembled food waste disposer "Shorio“
Mikuniya Corporation in Japan

Outline

- A system that adjusts the pH value of alkali as an alkaline water decomposition solution treatment device and decomposes and eliminates kitchen waste with alkaline adjusted water.
- The treatment method is different from the conventional treatment method in which bacteria decompose kitchen waste, and the drying treatment method in which kitchen waste is dried using a heater.



Good Practice Point

- The method does not need bacteria to be facilitated, and even suppresses the offensive odor of the food waste.
- Minimizing the odor issue makes it less likely for insects to approach.

References

- United Nations Industrial Development Organization. "Mishimax": A Volume Reduction System for Organic Waste Treatment [online] Available at: http://www.unido.or.jp/en/technology_db/5022/

3. Intermediate treatment /3R

3-8. Promotion of recycling
Ecobrick Movement
Philippines, England, Indonesia, and other countries

Target waste

Non-recyclable waste, PET bottles

Implementation entity

Ecobrick Alliance (not-for-profit enterprise)

Outline

- Ecobricks are made from plastic bottles tightly packed with non-biodegradable, non-recyclable wastes that will otherwise just be sent to landfill sites. These ecobricks, being compact and sturdy, are then used as building materials as hollow block substitutes.

Good Practice Point

- Repurposing of wastes for construction is not only eco-friendly but also cost-efficient. Each brick must be packed tightly in order to be used as a stable block substitute, with density of 0.30-0.70g/ml. They can be filled with household non-recyclable wastes like toothbrushes and sachets, plastic waste from coasts, or cigarettes.

Food pack incentives for making ecobricks during 2020 COVID 19 lockdowns

Ecobricks from Ecobricks Philippines used as construction material for fence

References

- Global Ecobrick Alliance. What is an ecobrick [online] Available at: https://www.ecobricks.org/what/ Ecobrick Alliance
- Ecobricks Philippines [online] Available at: https://www.facebook.com/ecobrickph/

3. Intermediate treatment /3R

3-9. Promotion of recycling Basuranihan Project

Sta. Rosa, Laguna, Philippines

Target waste

Recyclable Waste
(PET bottles)

Implementation entity

Sta. Rosa, Laguna

Outline

- A monthly ”Basuranihan Day” is held wherein registered individuals or groups with the City can earn prizes and points used to redeem items by bringing and selling recyclable materials to junk shops.

Good Practice Point

- The initiative encourages residents of Sta. Rosa, Laguna, to handle their wastes properly by segregating recyclables and giving it to the proper authorities for proper disposal.
- Communities also earn and receive tokens for participating in recycling, and the LGU uses the opportunity to provide education campaigns to further promote segregation.

Basuranihan 2013, Sta. Rosa, Laguna

References

- DENR EMB (2018) [online] Available at: https://emb.gov.ph/wp-content/uploads/2019/08/National-Solid-Waste-Management-Status-Report-2008-2018.pdf
- Palafox,F (2017) [online] Available at: http://www.ipsnews.net/2017/12/ecological-waste-management/

3. Intermediate treatment /3R

3-10. Promotion of recycling

WISHCRAFT - We Integrate Scholarship with the Collection of Recyclables and Frequently Generated Trash

Cavite, Philippines

Target waste

Recyclable wastes

Implementation entity

Cavite Institute

Outline

- WISHCRAFT, which stands for 'We Integrate Scholarship with the Collection of Recyclables and Frequently Generated Trash', allows students to use the accumulated funds they receive from selling recyclable materials including collecting old plastic bags, empty soda cans, scrap metal and used shampoo bottles, students can as payment for their tuition.

Good Practice Point

- Students are taught to appreciate proper waste management of recyclable materials as a means for them to continue their education.
- Poor families are able to send their kids to school by keeping these recyclable wastes off the streets, only paying an average of 75% of their kids' tuition fees.

WISHCRAFT Scholars collecting recyclables

Cavite Institute, Host of WISHCRAFT

Items	Project information
Commencement date	Piloted 2002 Launched 2004
Capacity	N/A
Target area	N/A

References

- DENR EMB (2018) [online] Available at: https://emb.gov.ph/wp-content/uploads/2019/08/National-Solid-Waste-Management-Status-Report-2008-2018.pdf
- Santos K. (2010) Philippines: Students Turn Trash into Tuition [online] Available at: http://www.ipsnews.net/2010/12/philippines-students-turn-trash-into-tuition/

3. Intermediate treatment /3R

3-11. Promotion of recycling
Plastic for Rice Program
Legazpi City and Angeles City, Philippines

Target waste

Recyclable wastes, particularly plastic waste

Implementation entity

Legazpi City, EMB Region 5
Angeles City, EMB Region 3
and local junkshop operators

Outline

- The program enables residents to receive rice in exchange for recyclables such as paper, bottles, scrap iron, aluminum and special waste such as broken appliances.

Good Practice Point

- Being identified as common wastes generated in the City of Legazpi, the LGU used the Plastic for Rice Program to promote recycling and move these recyclable wastes off the landfills, successfully reducing solid waste generated per capita per day from 0.5 kilograms (1.1 lb) in 2009 to 0.29 kilograms (0.64 lb) in 2015.
- Angeles City also implemented a similar program, giving a kilo of rice to residents for every kilo of plastic waste, to help manage wastes as well as to help residents by providing food, especially to families drastically affected by the COVID-19 pandemic.

Plastic collection for recycling

Plastic Collection Poster
Angeles City

Items	Project information
Commencement date	2010 (Legazpi) 2022 (Angeles)
Capacity	-
Target area	204.2 km^2

References

- DENR EMB Regional best practices and lessons learned [online] Available at: https://emb.gov.ph/wp-content/uploads/2018/09/3-Solid-Waste-1.8.pdf
- Solis E (2014) 20 Legazpi Villages Bag Good Solid Waste Management Awards [online] Available at: https://web.archive.org/web/20150928142212/http://legazpi.gov.ph/20-legazpi-villages-bag-good-solid-waste-management-awards/
- Fleming S. (2019) People can swap plastic waste for rice in this Philippines community [online] Available at: https://www.weforum.org/agenda/2019/09/in-this-philippines-community-people-can-swap-plastic-waste-for-rice/

3. Intermediate treatment /3R

3-12. Promotion of recycling
Recycling Drop off Sites, IEC, Promotion of recycle
Pasig City, Philippines

Target waste

Recyclable wastes

Implementation entity

Pasig City
Unilever
Cemex Philippines

Outline

- The program provides a holistic approach to managing recyclable wastes by holding education campaigns to residents, providing incentives for both residents and junk shop owners for properly sorted wastes.

Good Practice Point

- Unilever supports the program to manage the proper waste disposal of plastic wastes from their products, particularly sachet packs, while Cemex Philippines offer support by accepting the plastic waste as a cement additive to their products.

2020 launch of Walastik na Pasig program

References

- Unilever Philippines (2021) We're partnering with Pasig City to scale up plastic collection [online] Available at: https://www.unilever.com.ph/news/2021/plastic-collection-in-partnership/
- CNN Philippines (2021) Unilever Philippines to give incentives for sachet collection under 'Walastik na Pasig' [online] Available at: https://www.cnnphilippines.com/lifestyle/2021/2/27/unilever-philippines-to-give-incentives-for-sachet-collection-walastik-na-pasig.html?_=1614388300127&fbclid=IwAR0U_RrvvIR0VMkomgxSKV9y3aVMnfPiAK9z6W0-z3TQytKPn_H_O4w41xM

3. Intermediate treatment /3R

3-13. Promotion of recycling
Refuse derived paper and plastics densified Fuel
Hanoi, Vietnam and Philippines

Target waste

Paper and plastic waste

Implementation entity

DECOS in Vietnam,
GUUN in the Philippines

Outline

- Dai Dong Environment Solutions So., Ltd.（DECOS, associated company of Ichikawa Kankyo Engineering Co., Ltd., uses refuse paper and plastic fuel (RPF) to make pellets that are used in thermal power plant, mostly small scale, to treat domestic solid waste. Production volume is approximately 10 tons / day.

Good Practice Point

- Having a high calorific value, the pellets produced from paper and plastic are ideal to use in incineration facilities in place for coal to help in processing wastes that would otherwise go to landfill sites.

RPF Facility (GUUN's factory in Cebu)

Segregation (GUUN's factory in Cebu)

Pellets as final product from the URENCO waste treatment plant

References

- Truong N. (2018) Solid Waste Management in Vietnam [online] Available at: https://www.theseus.fi/bitstream/handle/10024/147214/Truong_Ngan.pdf?sequence=1&isAllowed=y
- Tomiyama A (2016) Venture to help Vietnam turn waste into substitute for coal [online] Available at: https://asia.nikkei.com/Business/Venture-to-help-Vietnam-turn-waste-into-substitute-for-coal
- GUUN Global Dissemination Pilot Project/Feasibility Study [online] Available at: http://www.guun.co.jp/service/global.html

3. Intermediate treatment /3R

3-14. Promotion of recycling
Waste bank (Bank Sampah)

Indonesia

Target waste

Recyclable wastes

Outline

- Waste bank is a system in which residents bring in recyclable wastes to sell to a recycler, and the profits generated are returned to the residents.
- In 2012, the Ministry of the Environment of Indonesia published implementation guidelines, which stipulate the roles of facilities, measuring of the weight and recording methods, etc.

Good Practice Point

- When collecting recyclable waste, the market value equivalent of recyclable waste is recorded in the "deposit passbook". Customers will be able to hand over recyclable waste to the garbage bank, save money in their account, and withdraw cash after a certain period of time.
- By transferring the responsibility of waste segregation and recycling, the cost shouldered by the local government is reduced.

Malang Waste bank


Recyclable waste classified into 72 types

Waste bank counter

Items	Project information
Commencement date	2008
Capacity	N/A
Target area	N/A

References

- Ni'Mah NZ, Keller-Bischoff L (2020) Java's Waste Banks [online] Available at: https://www.insideindonesia.org/java-s-waste-banks

3. Intermediate treatment /3R

3-15. Promotion of recycling
Act on Promoting Green Procurement
Japan and Taiwan

Outline

- Green procurement is defined as a practice whereby purchasers seek to procure goods and services with reduced environmental loads throughout their life cycle with consideration of their necessity, from suppliers who make constant efforts to be environmentally conscious.
- The government agencies including schools and public enterprises are required to only procure equipment and office supplies with eco-label to promote the use of environmentally-sound products.

Good Practice Point

- The policy encourages the use of environmentally-sound products and supports green enterprises while meeting budget constraints of the government institutions.

Stone paper uses less water to produce than the traditional wood paper

Bricks made from recycled clay that uses less electricity in production without compromising quality

References

- Act on Promoting Green Procurement [online] Available at: http://www.env.go.jp/policy/hozen/green/attach/gpp%20pamphlet_eng.pdf
- Shen S. Waste Management Policies and Services in Taipei [online] Available at: https://www.pecc.org/resources/infrastructure-1/1246-towards-zero-waste-society-new-management-policies-for-solid-waste-disposal-in-chinese-taipei-1/file
- The Rules and Regulations of Green Procurement in Taiwan [online] Available at: https://greenliving.epa.gov.tw/newPublic/Eng/GreenPurchase
- Her K. (2019) Going Green [online] Available at: https://taiwantoday.tw/news.php?unit=8&post=160968&unitname=Economics-Top-News&postname=Going-Green

3. Intermediate treatment /3R

3-16. Promotion of recycling
Smart Mobile Waste Transfer Centers
Istanbul, Turkey

Target waste

Plastic Bottles and Aluminum Cans

Implementation entity

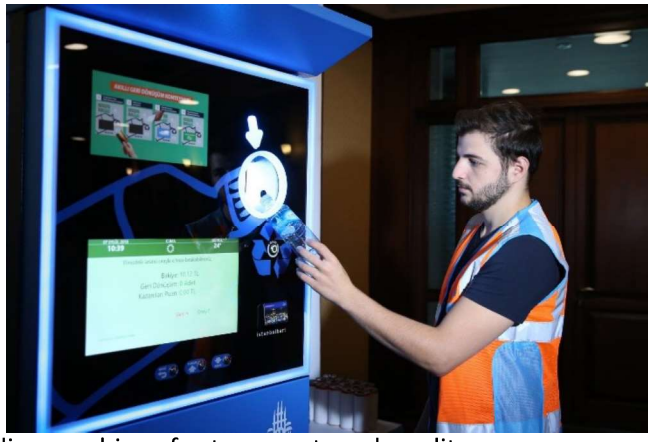
Istanbul City

Outline

- The City of Istanbul installed reverse vending machines that allow passengers to deposit plastic bottles and aluminum cans in exchange for credit in their subway cards.

Good Practice Point

- The implementation of a reward system instead of punishment system encouraged more people to recycle, dispensing over 35,000TL (over 200,000 PhP) worth of credits in exchange for waste deposits over the first 6 months of operation.



Depositing plastic bottles in reverse vending machines for transport card credits

Items	Project information
Commencement date	September 2018
Capacity	N/A
Target area	5243 km^2

References

- Sabah D. (2018) No cash for the bus fare? You can now top up your Istanbul card with recycled plastic bottles [online] Available at: https://www.dailysabah.com/istanbul/2018/09/06/no-cash-for-the-bus-fare-you-can-now-top-up-your-istanbul-card-with-recycled-plastic-bottles
- Sabah D. (2019) Plastic waste for free bus ride keeps Istanbul cleaner [online] Available at: https://www.dailysabah.com/istanbul/2019/03/01/plastic-waste-for-free-bus-ride-keeps-istanbul-cleaner

3. Intermediate treatment /3R

3-17. Promotion of recycling
Pant System

Sweden

Target waste

PET bottles and
Metal cans

Implementation entity

Returpack
Svenska AB

Outline

- The process of depositing bottles and cans in exchange for cash is called *panta*, and is already being exercised as early as 1984 in Sweden
- This helps Swedes to increase the percentage of recycling rate and avoiding of these wastes to be disposed irresponsibly.

Good Practice Point

- In 2016, 84.9% of its total aluminum can and PET bottle waste were gathered through the Pant System, totaling 1.8 billion cans and bottles collected, and in 2019, the recycling rate has exceeded 90%, proving just how big the contribution of this system is to the waste management efforts of the government.

depositing cans and bottles in machines

choosing to donate or encash amounted credits

Items	Project information
Commencement date	1984
Capacity	N/A
Target area	N/A

References

- The Local (2018) That's pant! The story behind Sweden's bottle recycling scheme [online] Available at: https://www.thelocal.se/20180328/thats-pant-the-story-behind-swedens-bottle-recycling-system
- Swedish PANT recycling system, all of Europe should be doing this! [online] Available at: https://www.youtube.com/watch?v=gtFfoMm8UUI

3. Intermediate treatment /3R

3-18. Promotion of recycling
Recycle at H&M
Sweden (available at all H&M stores worldwide)

Target waste

Unwanted clothes and textiles

Implementation entity

H&M

Outline

- Waste generated by the fashion industry has steadily increased with the introduction of fast fashion, where cheap clothing come and go shelves at a fast pace. H&M introduced this initiative to encourage users to give their old garments to H&M in exchange for vouchers, with an overall goal of helping in managing the waste produced in the fashion industry.

Good Practice Point

- This project launched the goal of H&M to only use recycled and sustainably-sourced materials by 2030 and being one of the biggest names in fast-fashion, contributes greatly to the reduction of waste being produced. To illustrate, in 2019 alone, they were able to solicit 29,000 tons of waste.

The looop machine used to recycle textile

Looop machine shredding fabric

Items	Project information
Commencement date	2013
Capacity	N/A
Target area	N/A

References

- H&M Group. Collect, recirculate and recycle [online] Available at: https://hmgroup.com/sustainability/circular-and-climate-positive/recycling.html
- Smith K. () H&M Wants To Recycle Your Old Clothing [online] Available at: https://www.livekindly.co/hm-recycle-your-old-clothing

3. Intermediate treatment /3R

3-19. Promotion of reuse
Tax Break for Repair

Sweden

Target waste

Used bikes, clothing and shoes

Implementation entity

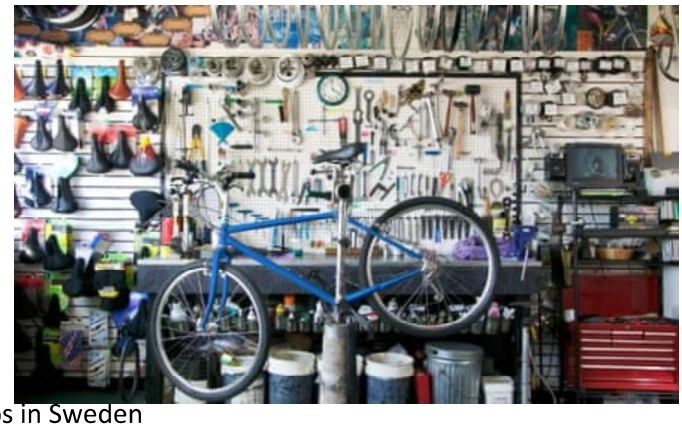
Sweden

Outline

- To combat the "throwaway consumer culture," Sweden introduced a sales tax reduction on repairs to clothes, bicycles, fridges, and washing machines from 25% to 12% to encourage consumers to invest in quality goods that can last them longer instead of cheap single use products.

Good Practice Point

- This initiative together with the tax break for repairs of white goods cost $54 million in lost taxes, but it is a cost that Sweden is willing to shoulder since they are expecting this amount to be outweighed by the stricter regulations for white goods, and the environmental impact of lesser consumption.



bike repair shops in Sweden

Items	Project information
Commencement date	January 1, 2017
Capacity	N/A
Target area	N/A

References

- Starritt A. (2016) Sweden is paying people to fix their belongings instead of throwing them away [online] Available at: https://www.weforum.org/agenda/2016/10/sweden-is-tackling-its-throwaway-culture-with-tax-breaks-on-repairs-will-it-work/#:~:text=To%20combat%20its%20'throwaway%20consumer,the%20person%20doing%20the%20work.

3. Intermediate treatment /3R

3-20. Promotion of reuse
Tax Break for Repair

Sweden

Target waste

Used white goods (refrigerator, washing machines, etc.)

Outline

- Sweden introduced tax break for repairs of white goods like refrigerators, washing machines, and usual household appliances. Given that labor cost comprises most of the fees in repairs, this discount is beneficial to both workers and consumers, encouraging consumers to purchase high quality goods that can last them longer.

Good Practice Point

- The government imposes a new tax on manufacturers in the use of harmful chemicals in making these white goods, encouraging the manufacturing industry to comply and produce more environmentally-sound goods. This shall offset the tax savings they give out through this initiative.

appliance repairs in Sweden boosts with tax breaks

Items	Project information
Commencement date	January 1, 2017
Capacity	N/A
Target area	N/A

References

- Starritt A. (2016) Sweden is paying people to fix their belongings instead of throwing them away [online] Available at: https://www.weforum.org/agenda/2016/10/sweden-is-tackling-its-throwaway-culture-with-tax-breaks-on-repairs-will-it-work/#:~:text=To%20combat%20its%20'throwaway%20consumer,the%20person%20doing%20the%20work.

3. Intermediate treatment /3R

3-21. Promotion of reuse
Resource Recycling and Reuse Act
Taiwan and other countries

Target waste

E-waste

Implementation entity

Taiwan, EU, China, etc.

Outline

- The increasing waste electrical and electronic equipment has alarmed governments worldwide, pushing Taiwan and several other countries to propose a resource recycling and reuse act to encourage businesses to recycle and reuse parts from discarded equipment instead of using virgin materials.

Good Practice Point

- Manufacturers are encouraged to improve their equipment design towards modularity to ease recovery of parts from discarded materials.
- In the EU, where in 2013 averaged 9.3 million tons of waste, forecasted to go up to 12.3 million tons by 2020, this Act led to the reduction of e-waste that will otherwise go straight to landfills.

untreated e-waste that have increasingly piled in landfills

Items	Project information
Commencement date	1998
Capacity	N/A
Target area	272.14 km^2

References

- US EPA (2012) Recycling Regulations in Taiwan and the 4-in-1 Recycling Program [online] Available at: https://www.epa.gov/sites/production/files/2014-05/documents/handout-1a-regulations.pdf
- Li L. Update on E-waste management in Taiwan [online] Available at: https://www.epa.gov/sites/production/files/2014-05/documents/taiwan.pdf

3. Intermediate treatment /3R

3-22. Promotion of appropriate waste management District Model of Waste as a Resource

Bangkok, Thailand

Target waste

Yard waste and food waste

Implementation entity

Suan Luang District

Outline

- Segregated collection of source separated yard waste and food waste from households and restaurants for diversion to composting facility and as animal feed.

Good Practice Point

- Community-based management; Promotes waste reduction and segregation via scheduled collection, provision of waste separation bins, establishment of SWM Learning Center.
- Collected waste average 3.4 tons/day for collected yard waste for composting, and an average 2 tons/day food waste collected from restaurants as animal feed.

Waste collection in Suan Luang District

Items	Project information
Commencement date	N/A
Capacity	N/A
Target area	1,568.74 km^2

References

- Johnson O, Trang N. Closing the Loop [online] Available at: https://www.unescap.org/sites/default/files/Closing%20The%20Loop_Sai%20Mai%20District%2C%20Bangkok%20Case%20Study.pdf
- Lammawichai J. Solid Wsate Management in Bangkok [online] Available at: https://www.jesc.or.jp/Portals/0/center/training/10thasia3r/8.10thasia3r_bangkok.pdf

3. Intermediate treatment /3R

3-23. Promotion of appropriate waste management Model Ward Initiative

NGT, New Delhi, India

Target waste

All type wastes

Implementation entity

New Delhi City

Outline

- Municipalities choose a “model ward” that embodies good waste management practices, consistent segregation, and strict compliance with SWM rules to encourage healthy waste management habits through healthy competition.

Good Practice Point

- Although implementation and consistency persists to be an issue, this initiative, along with rigorous IEC campaigns, increases participation and awareness steadily, and slowly helps in solving India’s waste problems.

Waste collectors ensuring proper segregation of wastes

Items	Project information
Commencement date	2019
Capacity	N/A
Target area	1484 km^2

References

- Ghosh S. (2019) How Delhi is dealing with waste segregation and disposal [online] Available at: https://www.thehindu.com/news/cities/Delhi/how-delhi-is-dealing-with-waste-segregation-and-disposal/article28023623.ece
- Times Now News (2019) Delhi municipal bodies identify 'model wards' to serve as examples of effective waste management [online] Available at: https://www.timesnownews.com/mirror-now/civic-issues/article/new-delhi-mcd-ngt-ideal-wards-solid-waste-segregation-management/395272

4. Landfill

Vital to the management of waste is ensuring that the wastes are properly housed in landfill facilities. Included in this section are examples of practices and technologies implemented in other countries that allow for a **safe and effective storage of waste in landfill facilities**.

4-1. Fences, retaining walls
4-2. Daily Soil Cover
4-3. Leachate Collection Pipes of Semi-aerobic landfill
4-4. Gas Ventilation System of Semi-aerobic landfill
4-5. Surface lining system
4-6. Holding basin and Regulating pond for leachate
4-7. Leachate Treatment Facility

4. Landfill

4-1. Fences, retaining walls

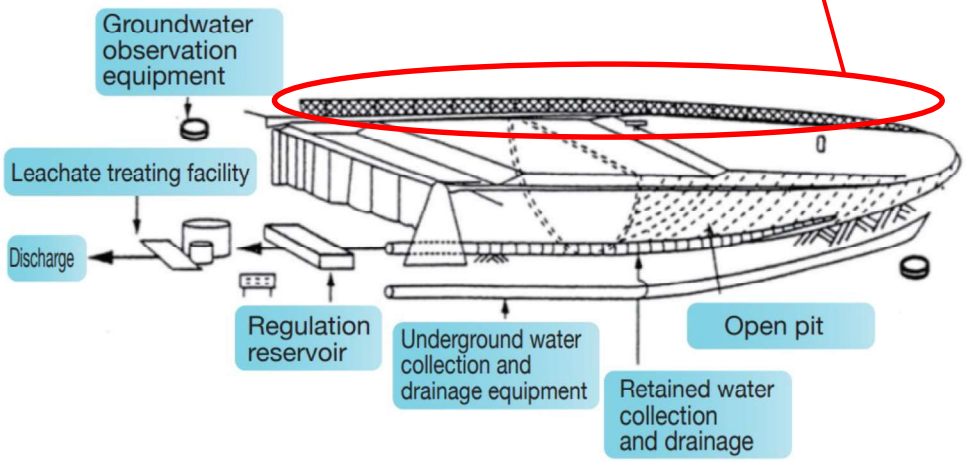
Japan and other countries

Outline

- Areas, where there is a danger of intrusion, should be enclosed by fences and closed to prevent people outside from entering landfills without permission.
- Regular inspection of fences and repairing of damaged parts is necessary to ensure the security and safety of the facility.

Good Practice Point

- Fences and retaining walls can limit access to people and prevent waste litter to the outside of the landfill site.
- Filling along fences and retaining walls enables planned landfills.



Controlled Landfill Sites

References

- MoEJ (Japan) HP [online] Available at: https://www.env.go.jp/en/focus/docs/files/20120201-29_13.pdf
- Ishizuka Construction Co., Ltd. Kashiwa City Final Disposal Site Fence Installation Work (Japan) [online] Available at: http://ishizukadoken.jp/publics/index/25/detail=1/b_id=82/r_id=20/

4. Landfill

4-2. Daily Soil Cover

Japan and other countries

Outline

- A soil cover is spread over the landfill waste at the end of the day to minimize the foul odor and prevent the waste from scattering.
- Daily soil cover will take up space in the landfill and reduce its overall capacity, so other methods like reusable top covers and watering may also be used as an alternative.
- It is important to divide the land into sections and systematically fill and cover it after filling to prevent foul odor and entering rainwater.

Good Practice Point

- Soil cover is useful not only for minimization of waste scattering, leveling and landscape protection, but also for prevention of smell, fire, and generation or attraction of pests such as flies.

Soil cover in Chiba prefecture

Watering at Kitakyushu City

References

- Chiba Sangyo Clean Co.,Ltd. Choshi City Obama Town Tsukuro Final Disposal Site [online] Available at: https://sangyoclean.co.jp/about_facilities/final_disposal/
- HIBIKINADA Development Co., Ltd. Aiming for the most beautiful disposal site in Japan [online] Available at: http://www.hibikidev.co.jp/sites/clean_hibiki.php

4. Landfill

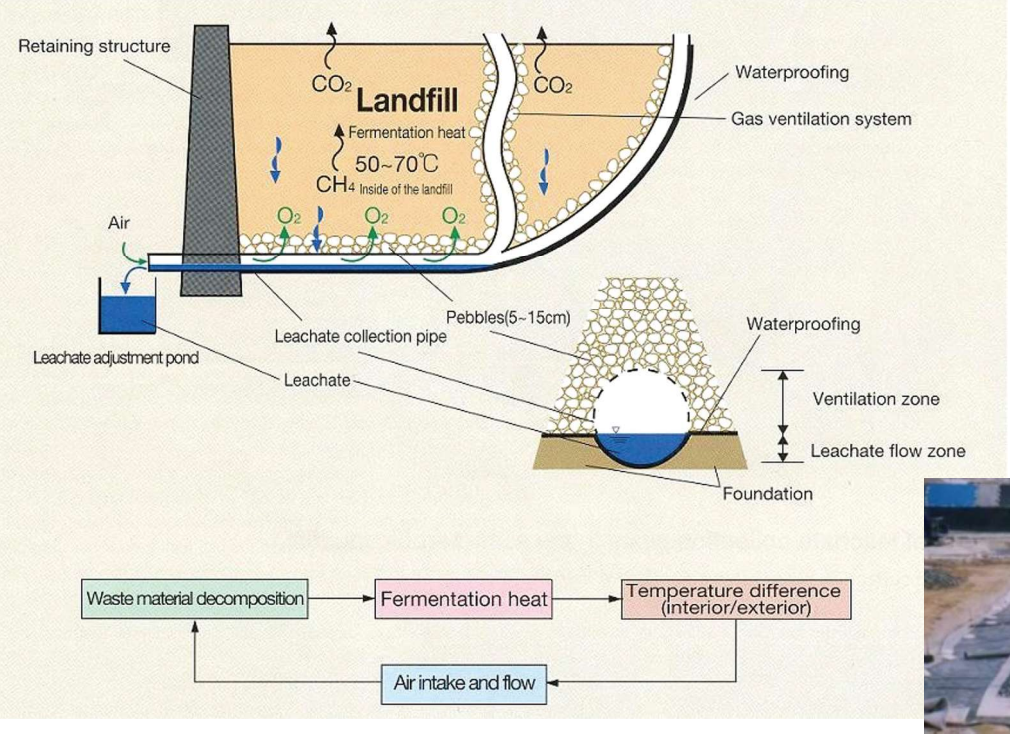
4-3. Leachate Collection Pipes of Semi-aerobic landfill
Japan and other countries

Outline

- A piping system is installed and provided to facilitate stabilization of the landfill.
- Regular inspection of pipes (leachate collection and gas vents) to ensure efficiency of system.

Good Practice Point

- The piping system allows for the drainage of leachate from the landfill while at the same time providing passage of air to ventilate the waste pile.
- Because of its large diameter, there is space for air to pass through. The heat generated by the microorganisms of organic material naturally generates airflow from the bottom to the surface, creating an aerobic environment in the landfill.



Conceptual Diagram of Semi-Aerobic Landfill Structure

Leachate Collection Pipes

References

- JICA Japan (2019) The Fukuoka Method [online] Available at: https://www.jica.go.jp/kyushu/english/office/topics/191001.html#:~:text=Prof%3A%20%22FUKUOKA%20Method%22%20is,disposal%20technology%20for%20solid%20waste.&text=Because%20of%20that%2C%20pipes%20are,leachate%20water%20is%20also%20reduced

4. Landfill

4-4. Gas Ventilation System of Semi-aerobic landfill
Japan and other countries

Outline

- Vertical piping systems are placed in landfill sites to collect gas for treatment. The gas ventilation system also serves as a leachate collection and drainage pipe.
- Extend the height of the pipe according to the depth of the landfill.
- Since the gas generated in the landfill often flows along the boundary between the seepage control and the soil cover and the waste, it is effective to install the ventilation device along the slope. In addition, if the landfill area is large, a vertical ventilation device should be installed inside the landfill.
- One degassing facility is necessary to be installed for every 2,000 m^2 in Japan.

Good Practice Point

- The piping system allows for air to escape, avoiding buildup of methane and other harmful gases in the landfill.
- The piping is surrounded by crushed stone to facilitate the passage of air. This structure creates an aerobic environment in the landfill, allowing organic materials to decompose faster and leachate to improve more easily.

Vertical piping system

References

- JICA Japan (2019) The Fukuoka Method [online] Available at: https://www.jica.go.jp/kyushu/english/office/topics/191001.html#:~:text=Prof%3A%20%22FUKUOKA%20Method%22%20is,disposal%20technology%20for%20solid%20waste.&text=Because%20of%20that%2C%20pipes%20are,leachate%20water%20is%20also%20reduced
- Aishin Co., Ltd. Type-R and Bio CR [online] Available at: http://aishin-co.jp/improvement/

4. Landfill

4-5. Surface lining system

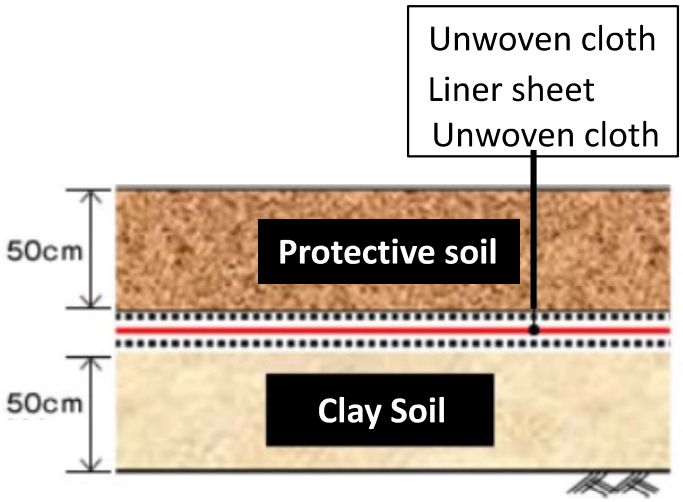
Japan and other countries

Outline

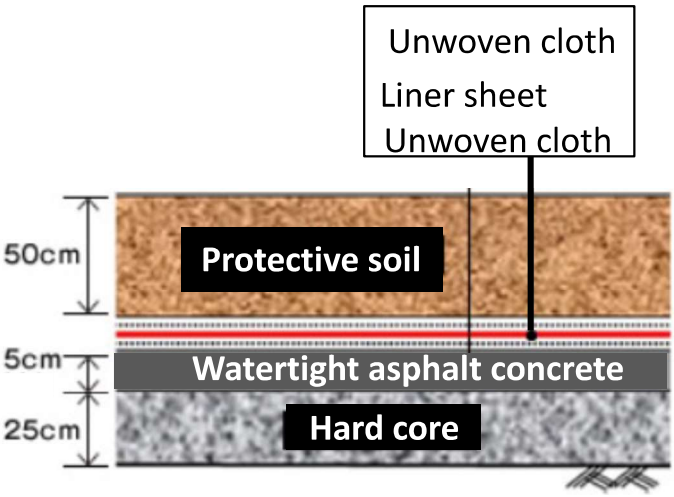
- Clay soil and liner sheet on the sides and bottom of the landfill prevents leachate from leaking from the landfill and contaminating the surrounding groundwater.
- In Japan, three types are specified:
  - Clay soil (Permeability: 1.0 x 10-6cm/s or less, thickness: 50cm or more) + liner sheet
  - Watertight asphalt concrete (5cm or more)+ liner sheet
  - Intermediate protection layer sandwiched between upper and lower of liner sheet (double liner sheet)
- If the surface lining is damaged, problems such as groundwater contamination due to leachate leakage may occur.

Good Practice Point

- Leachate through the landfill and rainwater through the outside of the lining structure can be collected separately, which reduces the amount of leachate to be treated.



Clay soil + liner sheet



Watertight asphalt concrete + liner sheet

References

- Kajima Corporation. Construction of Final Disposal Sites [online] Available at: https://www.kajima.co.jp/tech/indust_waste/disposal/index.html

4. Landfill

4-6. Holding basin and Regulating pond for leachate
Japan and other countries

Outline

- It is important to reduce and control the amount of water by collecting leachate in a storage area and evaporating naturally.
- However, large amounts of rainfall during the rainy season may cause leachate to exceed the capacity of the storage ponds and leak out or overflow
- It is effective to reduce the water volume by pumping up the leachate and using it for watering on the surface of the landfill.

Good Practice Point

- Once the leachate is collected in small holding basins, it is pumped up to a landfill or regulating pond. The quality of the leachate in each holding basin depends on the type of waste that the rainwater passes through. If a large amount of leachate is flowing due to heavy rainfall can be adjusted by increasing the storage capacity of the regulating pond.

Holding basins

Regulating pond

References

- Bureau of Environment. Wastewater treatment facility [online] Available at: https://www.kankyo.metro.tokyo.lg.jp/resource/landfill/environmental_pro/water_treatment/index.html

4. Landfill

4-7. Leachate Treatment Facility

Japan and other countries

Outline

- In Japan, leachate accumulated at the bottom of the landfill by natural flow is pumped up and stored in the leachate retention pond.
- The treatment process is roughly divided into “pre-treatment,” “biological treatment,” “coagulation sedimentation treatment,” “advanced treatment,” and “post-treatment,” and the best treatment technology is selected for each landfill. Treated leachate is discharged into river or sewers.

Good Practice Point

- The leachate treatment facility ensures the quality and safety of wastewater discharge in the landfill site through rigorous treatment to meet effluent discharge and water quality standards.

Leachate water (1: raw 2: after aeration 3: after filtration / adsorption)

References

- JICA Japan (2019) The Fukuoka Method [online] Available at: https://www.jica.go.jp/kyushu/english/office/topics/191001.html#:~:text=Prof%3A%20%22FUKUOKA%20Method%22%20is,disposal%20technology%20for%20solid%20waste.&text=Because%20of%20that%2C%20pipes%20are,leachate%20water%20is%20also%20reduced