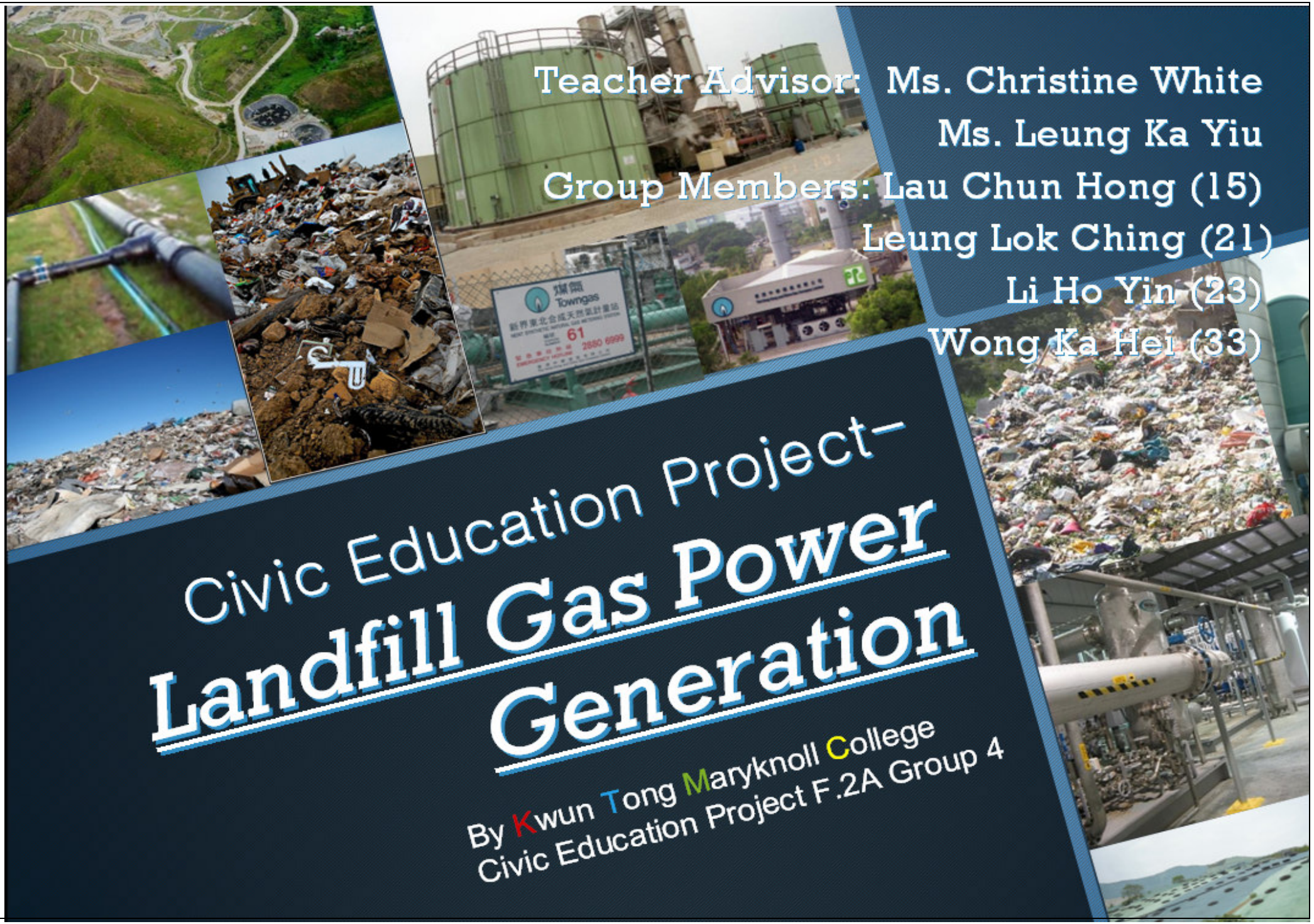

Teacher Advisor: Ms. Christine White
Ms. Leung Ka Yiu
Group Members: Lau Chun Hong (15)
Leung Lok Ching (21)
Li Ho Yin (23)
Wong Ka Hei (33)
Civic Education Project–
Landfill Gas Power Generation
By Kwun Tong Maryknoll College
Civic Education Project F.2A Group 4

Content

Briefing

The term "renewable energy" may be defined in several ways, and there is not at present a universally accepted definition. Generally speaking, renewable energy sources are secure and inexhaustible, in the sense that there is no problem of reserves being depleted. There're different kinds of renewable energy like solar energy, hydro-electric power, wind power…… etc. In this project, we'll explore one of the renewable energies, landfill gases.

The re-energy.ca, an environmental organization in Canada.

Aim

We are going to explore the process of landfill gas power generation and try to find out the difficulties of it being performed in Hong Kong since this kind of renewable energy can help slow down pollution instead of burning coal and petroleum. Also, since the effects of landfill gases are not remarkable in Hong Kong, we'll try to find out what the problem is. Is this the problem of less promotion by the government? Or the geographical features of Hong Kong reduce the effectiveness of landfill gases? We are going to answer all these questions in this project.

Methods

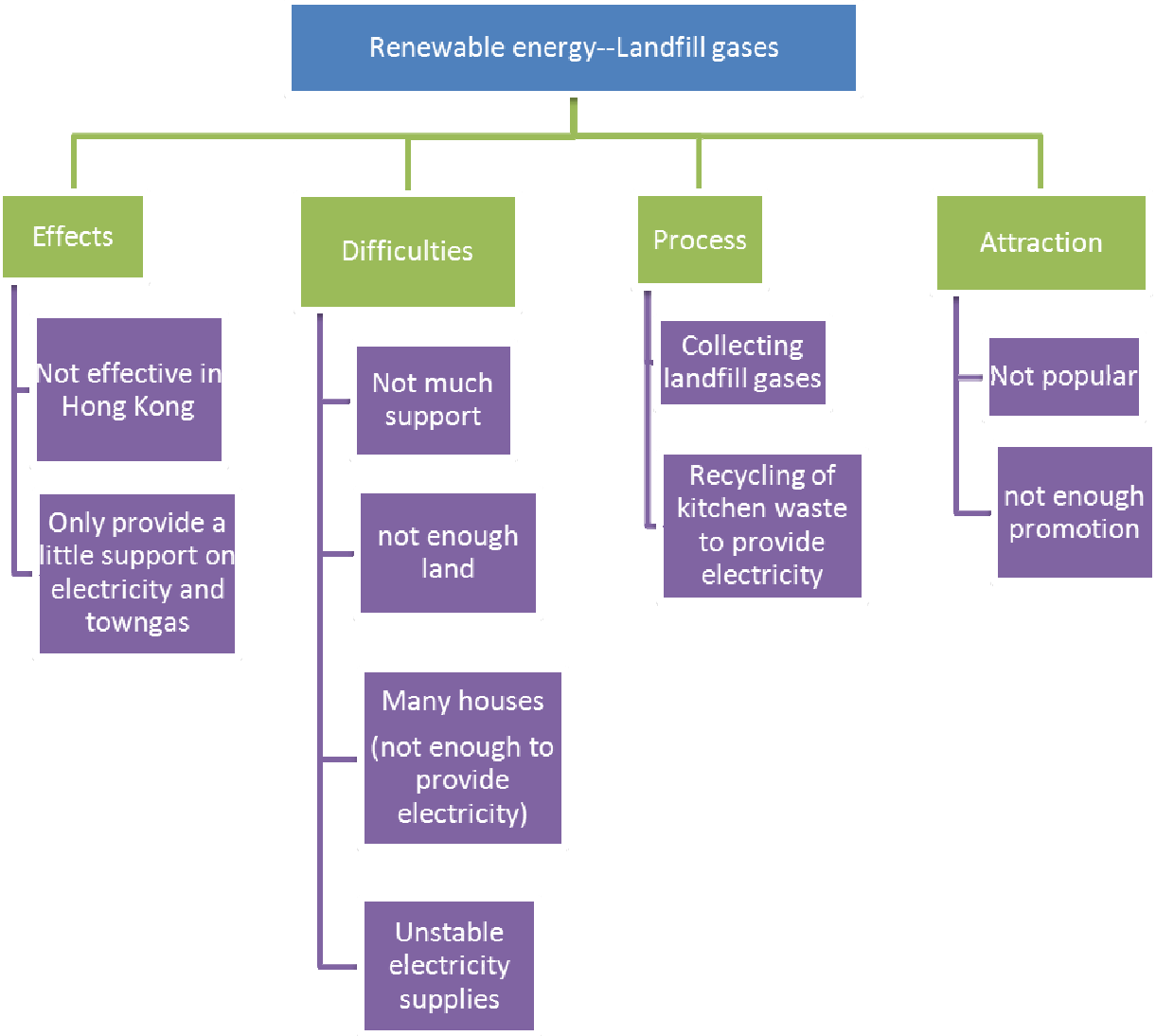
We are going to find the information we need through these ways:

Questionnaire

Interview

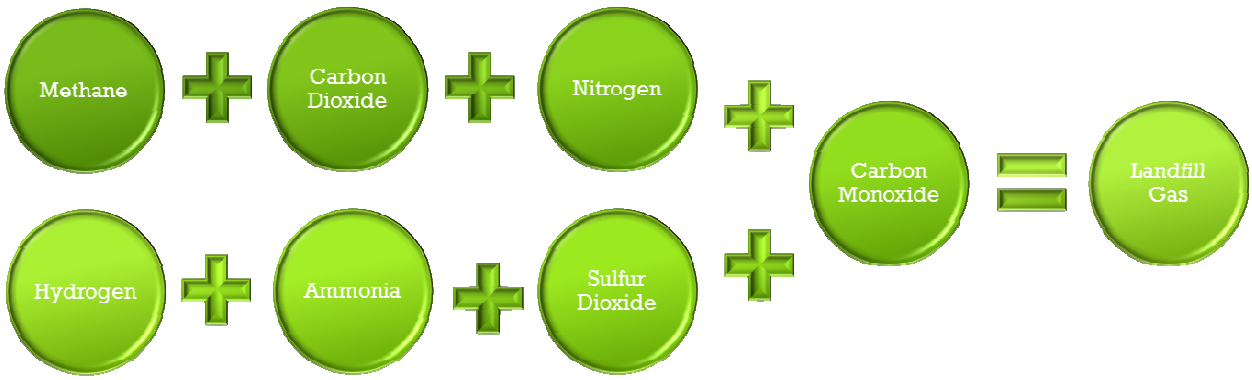
Site inspection

Mind map


Renewable energy--Landfill gases
Effects
Not effective in Hong Kong
Only provide a little support on electricity and towngas
Difficulties
Not much support
not enough land
Many houses (not enough to provide electricity)
Unstable electricity supplies
Process
Collecting landfill gases
Recycling of kitchen waste to provide electricity
Attraction
Not popular
not enough promotion

Introduction of Landfill Gas

Landfills gas is a kind of renewable energy. It may be transformed into electricity through different kinds of technology. After being used in generating electricity, it can serve as the medium calorific value fuel, or ventilate the propellant of high energy by which the fluid separation procedure and the solvent cleaning procedure elimination liquid state and the gaseous state pollutant.



Composition of Landfill Gas

In addition, the waste can have the unusual smell, so it is difficult to put it in any places. Therefore the spatial demand is also extremely big. However, the humanity can really make much trash. If we can use this kind of renewable energy, we can make the best use of things, and “waste” will be no longer “waste”.

Gases are produced in landfills due to the anaerobic digestion by microbes on any organic matter. This gas can be collected and flared off or used to generate electricity in a gas fired power plant. Landfill gas monitoring can be carried out to alert for the presence of a build-up of gases to a harmful level.

South East New Territories (SENT) Landfill,
one of the three strategic landfills in Hong Kong

Landfill Gas to Energy at Closed Landfills

Closed Landfills	Quantity of Gas Collected (cubic meter per hour)	Modes of Landfill Gas Utilization	Quantity of Gas Utilized (cubic meter per hour)
Shuen Wan	293	Gas treated and piped to Towngas for use as fuel	288
Jordan Valley	96	Electricity generation for on-site use and leachate treatment	9
Tseung Kwan O Stage I	674	Electricity generation for on-site use	24
Tseung Kwan O Stage II/III	1,288	Electricity generation for on-site use; used for heating in the leachate treatment process	1,125
Gin Drinkers Bay	215	Used for heating in the leachate treatment process	215

***The above figures are average figures in 2008, EPD**

Questionnaire

In order to know how much the citizens understand landfill gas power generation, we made a few questionnaires and distributed them to the citizens. We had our interviews in Kowloon Bay and at the Kowloon Bay MTR station.

According to the result of our questionnaire, lots of people have not heard of landfill gas power generation before, which shows that the promotion by government is not enough.

Some of the interviewees thought that landfill gas power generation are dangerous, which shows that they do not understand the process of generating power which is safe enough.

They are also afraid that landfill gas power generation could affect the environment and speed up the global warming.

Interview

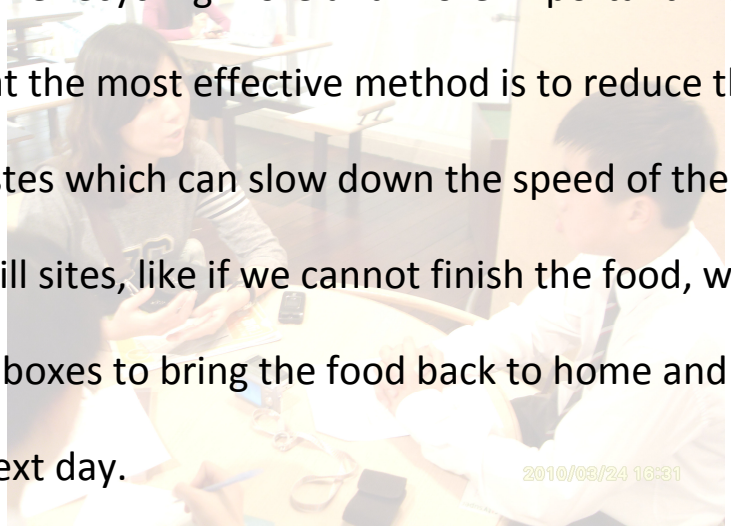
Interviewee: Ms. Kwok Ying Ying

(The project officer of Greener's Action)

On 24/3, we interviewed with Ms. Kwok Ying Ying, the project officer of Greener's Action. During the interview, we've discussed the method and the difficulties of handling kitchen wastes, which occupies more that 30 per cent of solid waste.

Ms. Kwok said that if the kitchen wastes can be handled well, can be turned into the fertilizer of poultry, pigs or even fish. Also, the landfill gases produced by the kitchen wastes can be a large support for the production of electricity and town gas.

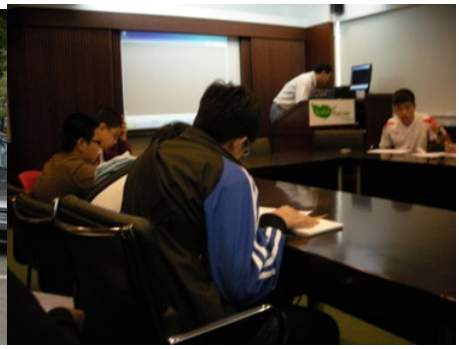
Moreover, if the government promotes recycling well, it may also be a commercial opportunity. For example, it may create jobs and make recycling more and more important. However, she said that the most effective method is to reduce the kitchen wastes which can slow down the speed of the overflow of the landfill sites, like if we cannot finish the food, we can bring lunch boxes to bring the food back to home and finish it again the next day.



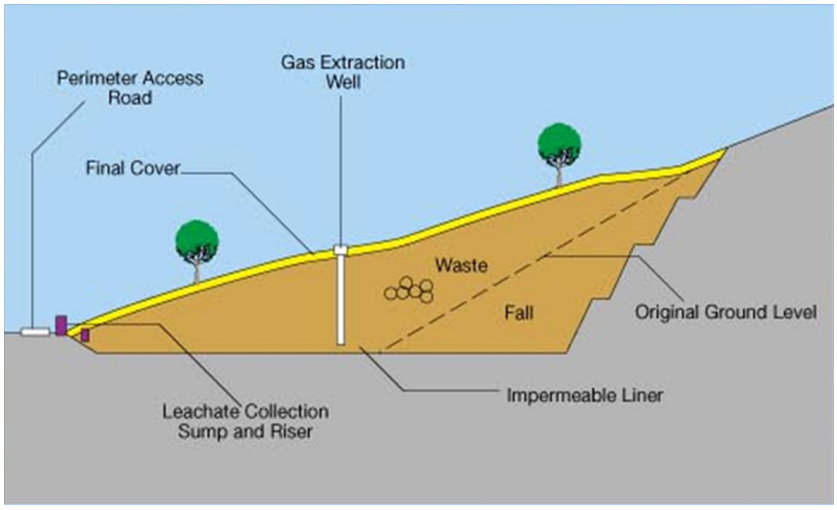
Ms. Kwok also told us the difficulties of performing kitchen wastes recycling in Hong Kong. Since the amount of kitchen wastes is huge, the government or organizations cannot recycle all those wastes produced by us every day. Secondly, since Hong Kong has few lands, the government cannot build many landfills or places to recycle those wastes.

Photos of the interview

Site Inspection



In order to know more about the landfill gas power generation system, our group and a few more students went to visit the North-East New Territories landfill (NENT) at Ta Kwu Ling on 30th April, 2010. The area of the NENT landfill is about 1228.8 hectare (ha).



Cross-section of the landfill site

In the landfill site, we could see a lot of plastics in the colour of green. They are used to cover those wastes which do not have any space to fill in more waste. There are many wheels on the plastics. We can also see a generator in the site.

According to the engineer's speaking, there are many Landfill Gas Collection well inserted into the wastes to collect landfill gas. They will be sent to the generator to generate power and is used in the offices in NENT.

The speaker told us that the power generated from the landfill gas is very large, but he also told us honestly that the electricity is often suspended due to the impure gas. Moreover, since the companies, China Light and Power (CLP) and Hong Kong Electricity Company Ltd. (HEC) are not using the power generate from landfill gas, it cannot be used in cities.

Photos of the site inspection

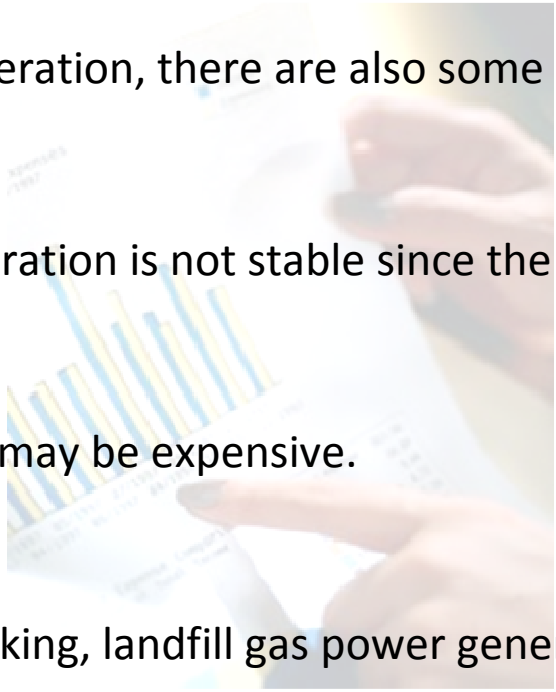
Analysis

After we had done the research, interview and questionnaire, we know that there are many benefits if we generate power from the landfill gas.

1. Since landfill gas is degraded from the rubbish, the amount of rubbish may reduce and the life of the landfill sites may extend if we generate power from the landfill gas.
2. Methane may be released during the process of degrading landfill gas from the rubbish. It may cause greenhouse effect. The landfill gas power station needs to collect landfill gas which contains methane, so this may reduce the greenhouse effect.

3. As rubbish is produces every day, the amount of landfill gas is also stable, which may not be finished very soon. So it may replace coal with generated power some day.

Although there are many benefits in performing landfill gas power generation, there are also some bad effects.



1. The generation is not stable since the landfill gas is impure.
2. The cost may be expensive.

Generally speaking, landfill gas power generation can help solve the problem of global warming. Global warming is a very serious problem. In order to solve it, everyone has the responsibility to save the world. If each person could make a little change in his or her life, it can produce a large energy to solve this problem.

Suggestions

1. The Hong Kong government could attract talents from USA or Japan to improve skills in controlling the landfill gas power generation.
2. The China Light and Power (CLP) could build a tunnel to the landfill sites, which could lower the cost of sending the gases to the factory to generate power.
3. The government could sell the landfill gases with a lower cost. It can lower the cost of landfill gases production.
4. The government can sponsor the project of generating power from the landfill gases, which could help to lower the payment of CLP.

Conclusion

In this project, we know that many citizens in Hong Kong didn't know much about landfill gases by the questionnaire, this is mainly because of the propaganda of our Hong Kong government. Also the landfill gases are dangerous. Many of Hong Kong citizens are afraid of this. We think that the landfill gases can only be used for producing electricity, but it can't supply electricity for Hong Kong citizens because the trash is not enough.

In nowadays, some countries are using the landfill gases to generate power, which shows that this policy is workable. In conclusion, although there are some bad effects if we perform this policy, we think that the benefits outweigh the bad effects, so we strongly suggest the government to perform this policy in different places of Hong Kong.

Anyway, we hope that the Hong Kong citizens, our teachers and classmates can understand more about landfill gas power generation, and we hope that the policy will be carried out one day.

Feelings

- Li Ho Yin 2A(23)

I have got an unforgettable memory in this project. Firstly, the title of this project, “landfill gas power generation” is fresh to me, so I am curious about this project. Actually, I was not familiar to this topic at first, but after we interview the citizens through the questionnaire, I found that many citizens have not heard of landfill gas as me. This shows that the promotion of the government is not enough. I had a deep impression on the site inspection. This is because it was a precious experience. I also learn a lot about landfill gases in the landfill site, such as the landfill gases being transferred to the generator through a duct.

- Lau Chun Hong 2A(15)

After this project, I learnt many things. They are not just related to this topic, landfill gases. Although I learnt something about landfill gases, like the uses of landfill gases, what is landfill gas, how landfill gases generate power, etc., the main thing that I learnt is how to cooperate with my group mates. It is also the main point that we need to learn in our life, but not just in F.2. We can make use of it in the future. Also, I am proud that I went to the landfill site with my classmates. I took many photos there. I cannot forget what happened there.

- Wong Ka Hei 2A(33)

After this long project, I know landfill gases very well now. I've gained a lot of knowledge about landfill gases. At the beginning of the project, we're starting to do the project in other topic, but unfortunately, we couldn't find any supportive information about it, so we had to change another topic, and the new topic is what we're using now. Although we didn't have much time to do preparation on this topic, our cooperative team members have tried our best to make a thorough inquiry on this topic. In this project, I've had many first times, like the first time to crossover with other teams, the first time to go to the landfill site…etc. This is the happiest and the most memorable project I've ever had.

- Leung Lok Ching 2A(21)

In this project, I have learnt a lot of things. Other than the process and the information of landfill gases, I learnt to stay calm when interviewing people and question the interviewees politely. Besides, I have never thought of visiting the landfill site since I am just a Form 2 student. My parents even said that I am doing something that the university students do. Anyway, if we do not have the help of our teacher advisors, Mrs. White and Ms. Leung, we cannot visit the landfill and write in English.

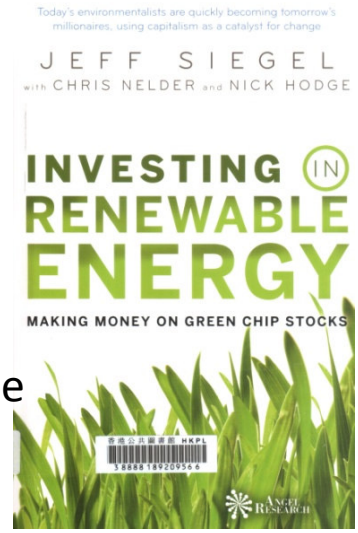
Division of labor

Lau Chun Hung	Briefing(the use of landfill gases),Summary
Leung Lok Ching	Questionnaire analyzing, Landfill site visiting, translation
Li Ho Yin	Summary after the questionnaire analyzing, Analyze
Wong Ka Hei	Briefing, mind map, interview, Powerpoint design

Sources (Websites)

- http://www.epd.gov.hk/epd/english/environmentinhk/waste/prob_solutions/msw_lgu.html
- http://en.wikipedia.org/wiki/Landfill
- http://re.emsd.gov.hk/eindex.html
- http://hk.search.yahoo.com/image

Sources (Books)



- Investing Renewable energy

  Authors: Jeff Siegel, Chris Nelder, Hick Hodge

  Pages: 247

  Pages read: 'Chapter 6: What's that smell?'

  P.109-118

  Publisher: Angel Publishing

  Printed in the United States of America

- Energy Systems and Sustainability

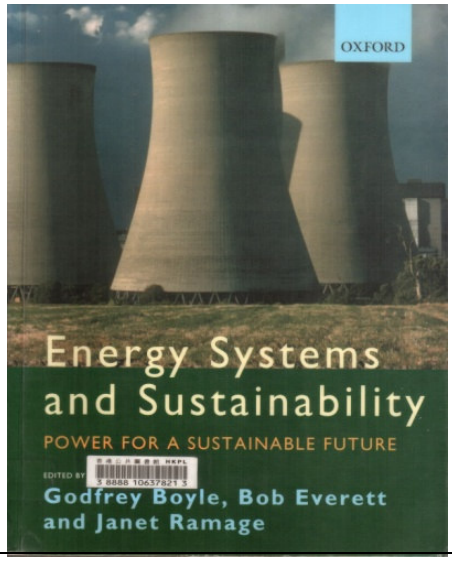
  Authors: Godfrey Boyle, Bob Everett, Janet Ramage

  Pages: 607

  Pages read: 'Power station boilers' P.177-178

  Publisher: Oxford University Press

  Printed in the United Kingdom



Acknowledgement

- Hong Kong Environmental Protection Department (EPD)
- Greener's Action 綠領行動 Greeners Action
- Teacher Advisors:

Ms. Christine White, Ms. Leung Ka Yiu

Content of Appendix

Interview questions

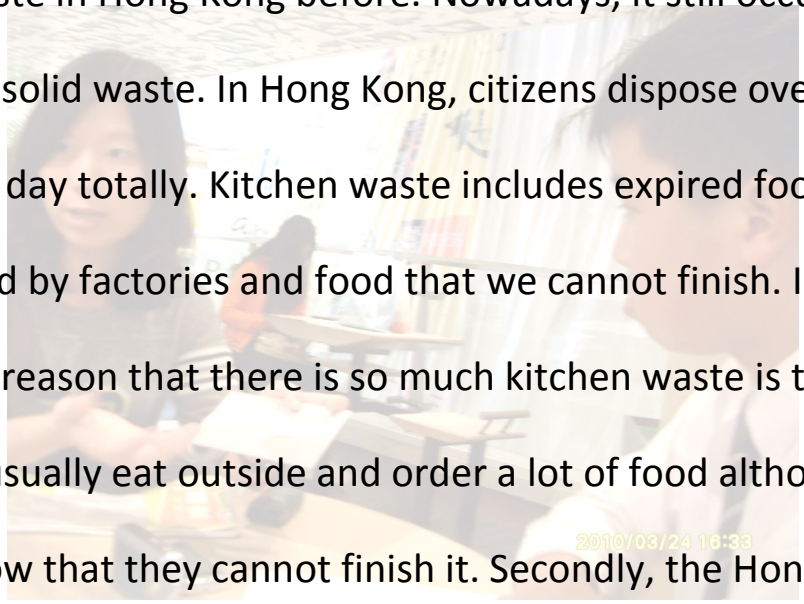
Interviewee: Miss Kwok @ Greener's Action

Time: 30 minutes

Venue: Food court of APM

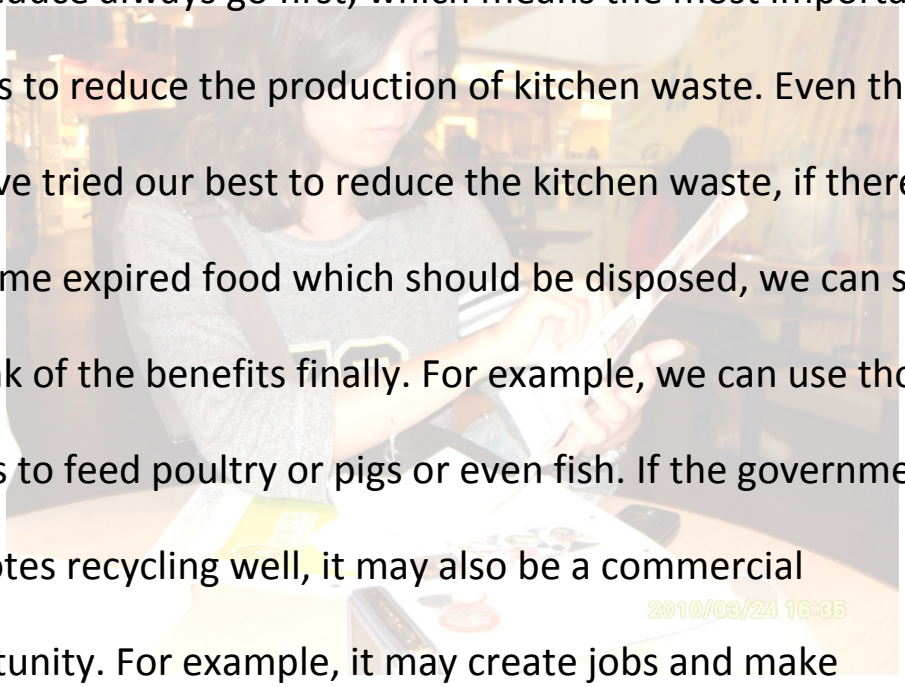
Q1. Why are there so many kitchen wastes in Hong Kong?

A: According to our research, kitchen waste occupies 41% of solid waste in Hong Kong before. Nowadays, it still occupies 30%+ of solid waste. In Hong Kong, citizens dispose over 2995 tons per day totally. Kitchen waste includes expired food, food produced by factories and food that we cannot finish. I think that the reason that there is so much kitchen waste is that people usually eat outside and order a lot of food although they know that they cannot finish it. Secondly, the Hong Kong government does not introduce a policy to recycle kitchen waste properly, so all of the kitchen waste goes to the landfills and increases the chance of making the landfills full.



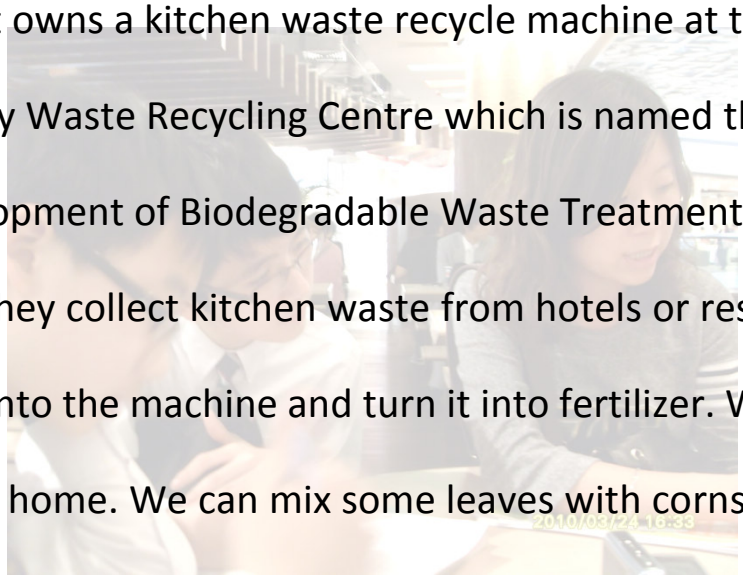
Q2. If we treat those wastes properly, what benefit can we have?

A: I think that the first thing we should think about is not how to treat those kitchen waste so that we can have benefits. In 3Rs, reduce always go first, which means the most important thing is to reduce the production of kitchen waste. Even though we have tried our best to reduce the kitchen waste, if there is still some expired food which should be disposed, we can start to think of the benefits finally. For example, we can use those wastes to feed poultry or pigs or even fish. If the government promotes recycling well, it may also be a commercial opportunity. For example, it may create jobs and make recycling more and more important. Since kitchen waste may release methane, the damages to the environment are more than the damages caused by carbon dioxide. So if we can reduce the amount of kitchen waste, it must be a great benefit to the environment.



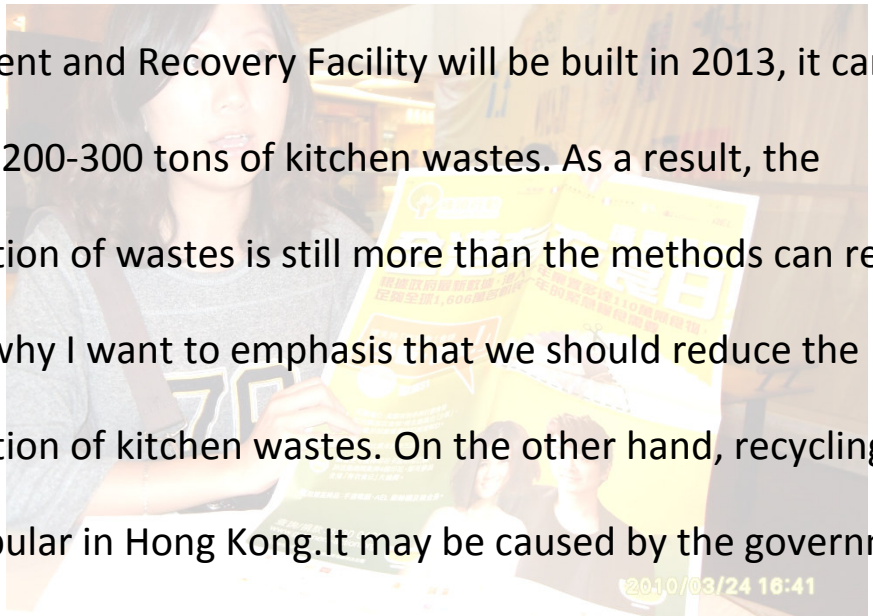
Q3. What are the methods and the process of recycling kitchen waste?

A: Firstly, I would like to talk about the process of turning the kitchen waste into fertilizer. The Environmental Protection Department owns a kitchen waste recycle machine at the Kowloon Bay Waste Recycling Centre which is named the ‘Pilot Plant Development of Biodegradable Waste Treatment Facilities’. They collect kitchen waste from hotels or restaurants, then put it into the machine and turn it into fertilizer. We can also try it at home. We can mix some leaves with corns. Besides, we can also turn the kitchen waste into feed by some other machines.



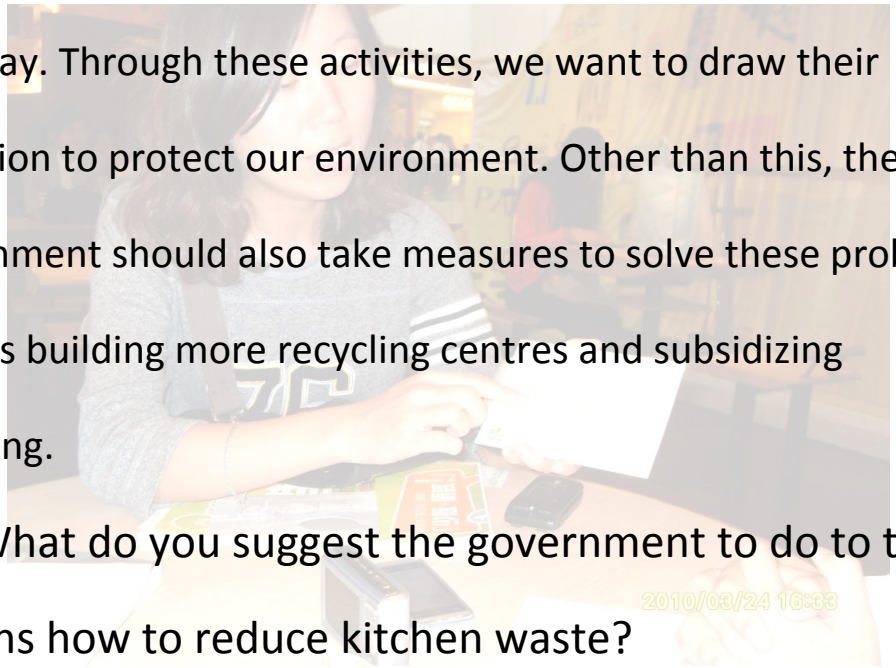
Q4. What is the difficulty of recycling kitchen waste?

A: Firstly, since the amount of kitchen wastes is huge, the government or organisations cannot recycle all those wastes produced by us every day. Secondly, since Hong Kong has few lands, the government cannot build many landfills or places to recycle those wastes. Although the Siu Ho Wan Organic Waste Treatment and Recovery Facility will be built in 2013, it can only recycle 200-300 tons of kitchen wastes. As a result, the production of wastes is still more than the methods can reduce. That's why I want to emphasis that we should reduce the production of kitchen wastes. On the other hand, recycling is not popular in Hong Kong.It may be caused by the government since they do not subsidize and promote this project. These are the difficulties of recycling kitchen wastes.



Q5. What methods do you suggest to solve these problems?

A: Since there are so many wastes, Greener's Action provides many activities to call upon Hong Kong citizens to treasure food. For example, if we cannot finish the food, we can bring lunch boxes to bring the food back to home and finish it again on the next day. Through these activities, we want to draw their attention to protect our environment. Other than this, the government should also take measures to solve these problems such as building more recycling centres and subsidizing recycling.

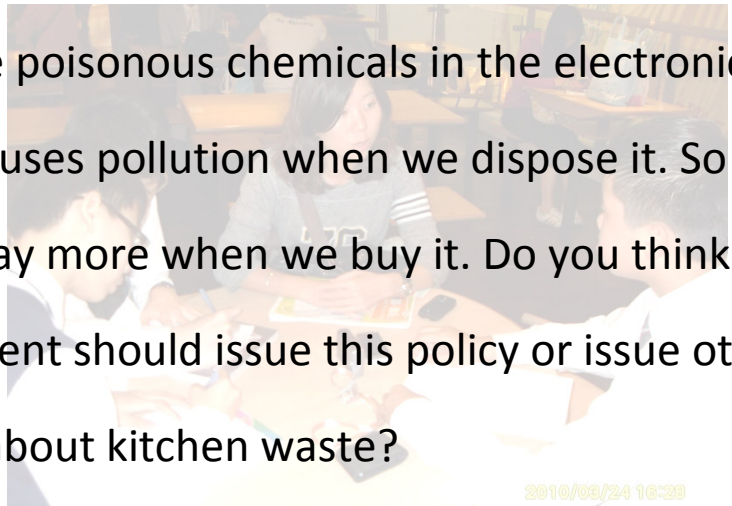


Q6. What do you suggest the government to do to teach citizens how to reduce kitchen waste?

A: In Taiwan, South Korean and some other countries, there is a law which forbids kitchen waste from going to landfills. It is because the amount of kitchen waste is too large, and they may release methane. Secondly, in some countries, people must pay for a plastic bag to hold all of your domestic waste. As a result, if you have a lot of domestic waste, you have to pay a

lot to buy many bags to hold all of your wastes. Then people may begin to reduce the production of wastes in order to pay less. So I suggest the government follow these countries to introduce such policies.

Q7. In the current months, the government have issued a policy and which being consulted. It is that since there are some poisonous chemicals in the electronic products, it may causes pollution when we dispose it. So we should pay more when we buy it. Do you think the government should issue this policy or issue other policies about kitchen waste?



A: I think that the government should issue both policies. It is because all of these policies are under a project called producer responsibility schemes (PRS). It is that the producers of wastes should pay more taxes than those who produce less. In Hong Kong, many kinds of waste are produced every day, such as plastic bag and the electronic products. For the electronic products, when we dispose it, they will produce a lot of poisonous chemicals such as lead and mercury, and they will be

sent to the third world countries. This may damage the environment. So there are some countries forbid to import the electronic waste from other countries. This policy will be issued in China in 2014 too. So where should we send the wastes to in the future if China and some countries do not receive them? In order to solve these problems, we should have a piece of land or a place to handle these wastes in the future. Other than this, the problem of kitchen waste is also serious, so we cannot compare these two problems.

Sample of Questionnaire

Q1. How old are you?

☐<20 ☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐>60

Q2. Have you heard of "renewable energy" ?

☐ Know very well ☐ Familiar ☐ Not familiar ☐ Never or nearly never heard of it

Q3. Have you heard of "landfill gas power generation" ?

☐ Familiar ☐Not familiar

Q4. Do you think that landfill gas power generation is important?

☐ Important ☐ Not very important ☐ Not important

Q5. Do you think that promoting landfill gas power generation will bring benefits?

☐ Benefits prevails disadvantages ☐ Neutral ☐ Disadvantages prevails benefits

Q6. Do you think that promoting landfill gas power generation will have an obviously good result?

☐ Excellent result ☐ Obviously good result

☐ Neutral ☐ Good result is not obvious

Q7. Do you support the government to promote landfill gas power generation?

☐ Support ☐ Neutral ☐ Do not support

Q8.Do you think that the publicity by for promoting landfill gas power generation is sufficient?

☐ More than sufficient ☐ Sufficient ☐ Insufficient ☐ Very insufficient

Result of Questionnaire

Q1. How old are you?

☐<20(40) ☐ 20-29(8) ☐ 30-39(9)

☐ 40-49(12) ☐ 50-59(9) ☐>60(2)

Q2. Have you heard of "renewable energy" ?

☐ Know very well (4) ☐ Familiar (57)

☐ Not familiar (15) ☐ Never or nearly never heard of it (4)

Q3. Have you heard of "landfill gas power generation" ?

☐ Familiar (32) ☐ Not familiar(48)

Q4. Do you think that landfill gas power generation is important?

☐ Important (41) ☐ Not very important (31) ☐ Not important (8)

Q5. Do you think that promoting landfill gas power generation will bring benefits?

☐ Benefits prevails disadvantages(22) ☐ Neutral(41)

☐ Disadvantages prevails benefits(17)

Q6.Do you think that promoting landfill gas power generation will have an obviously good result?

☐Excellent result(2) ☐ Obvious good result (16)

☐Neutral (43) ☐Good result is not obvious (19)

Q7. Do you support the government to promote landfill gas power generation?

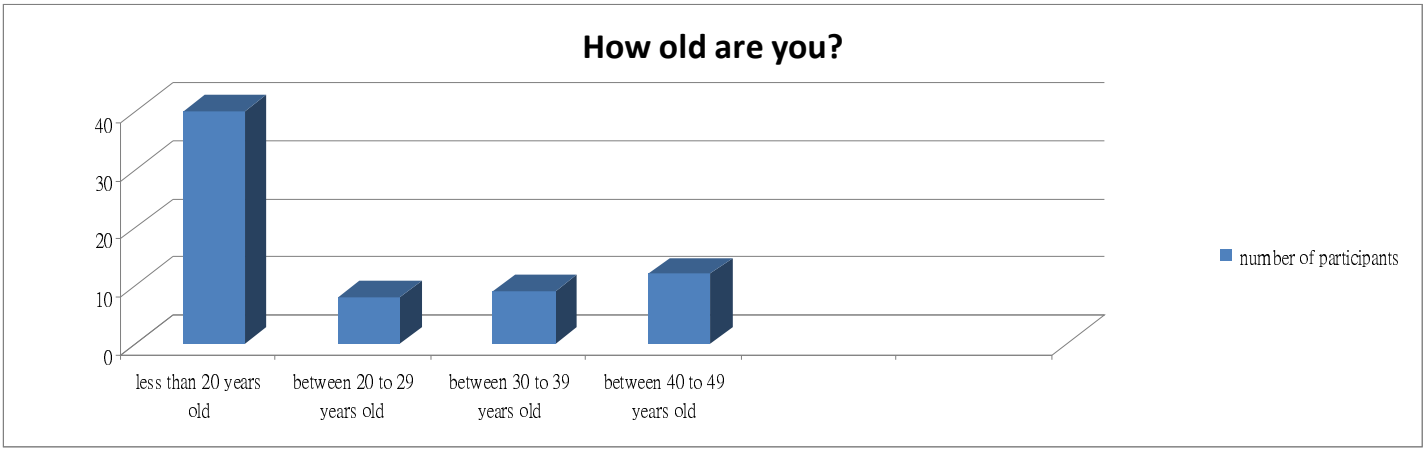
☐ Support (29) ☐ Neutral (32) ☐ Do not support (19)

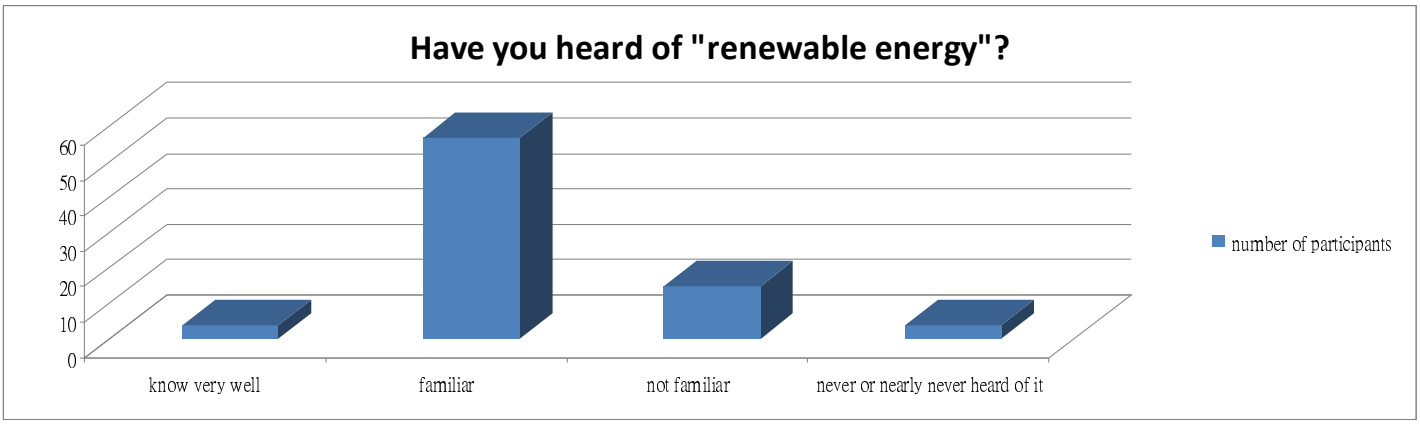
Q8.Do you think that the publicity by for promoting landfill gas power generation is sufficient?

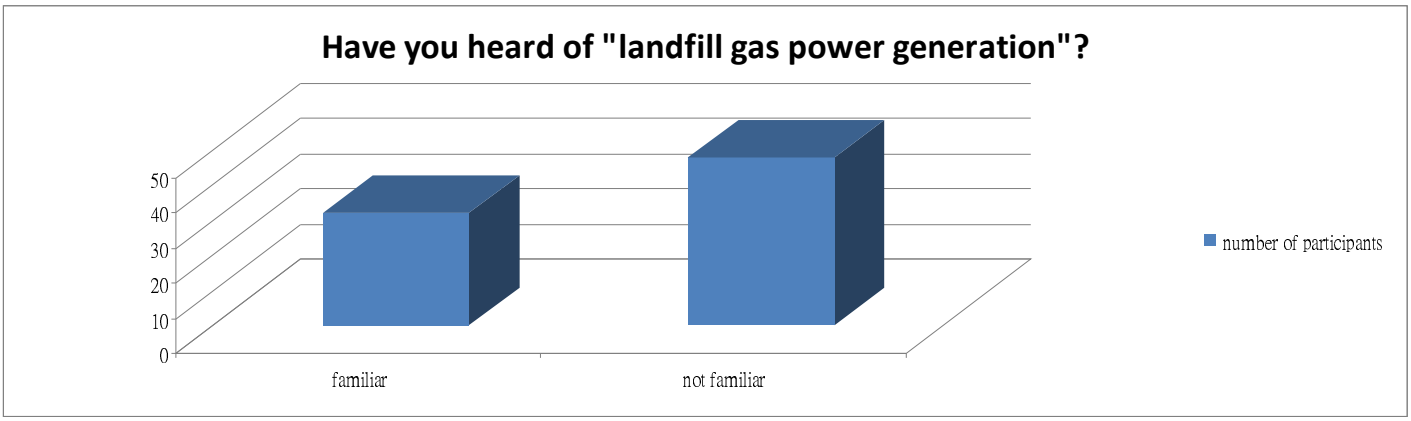
☐ More than sufficient(0) ☐ Sufficient (3)

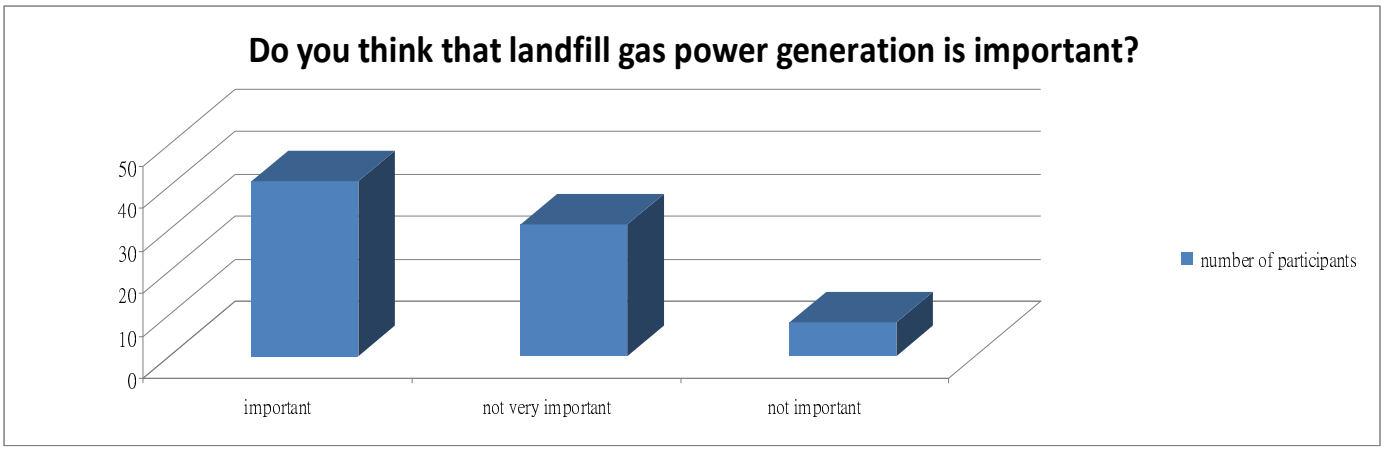
☐ Insufficient (40) ☐ Very insufficient (37)

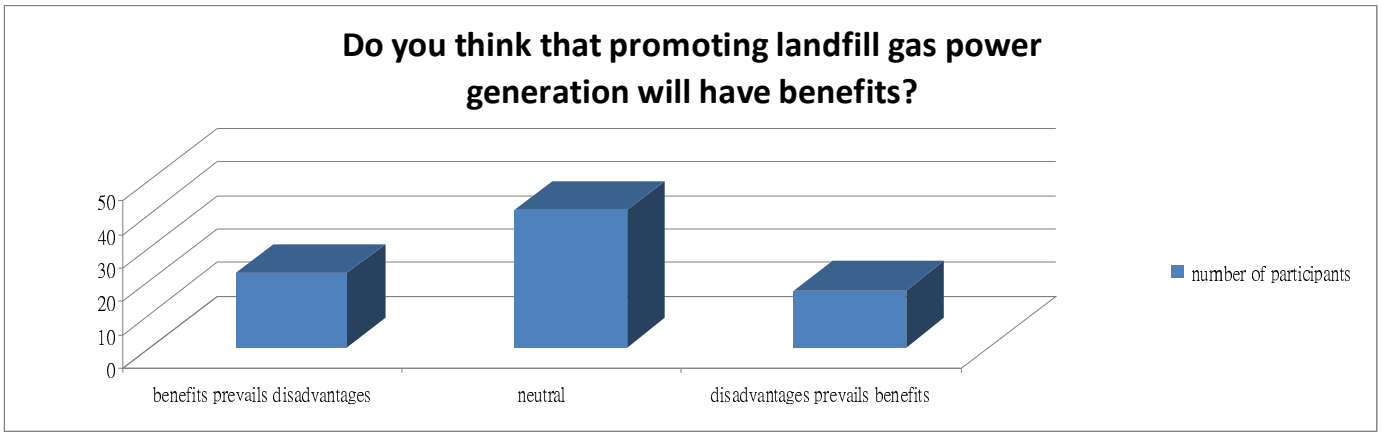
Result of Questionnaire (Bar Chart)

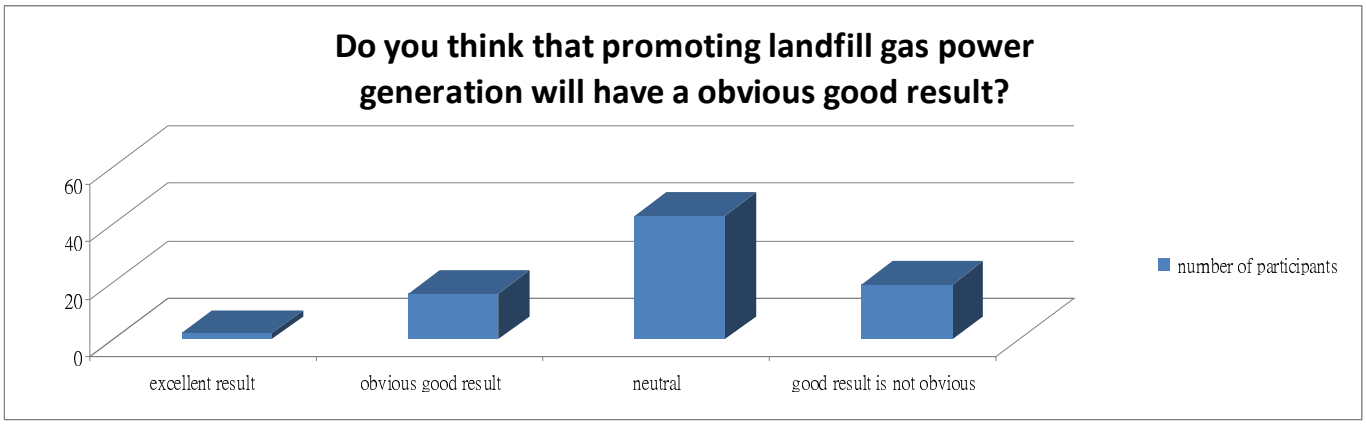


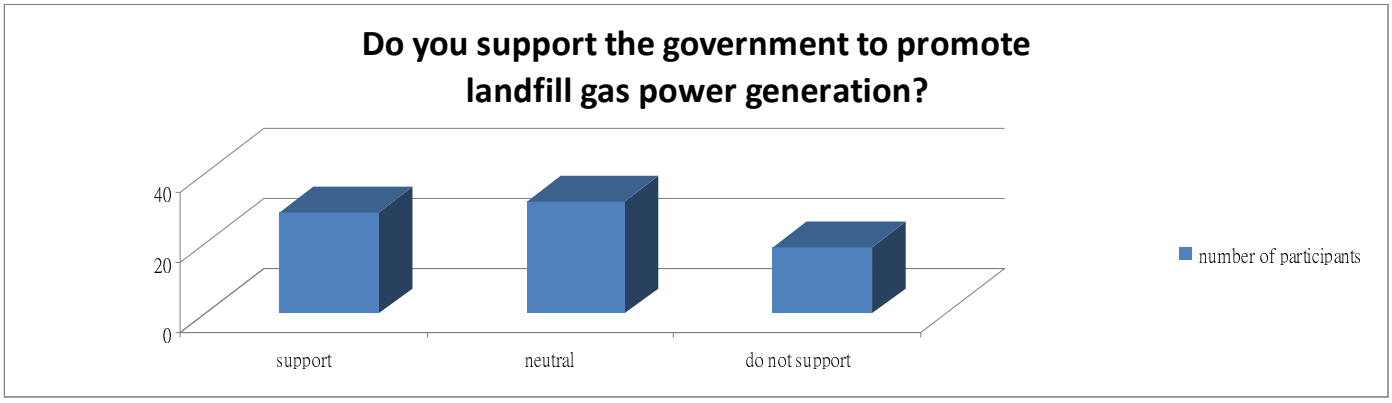


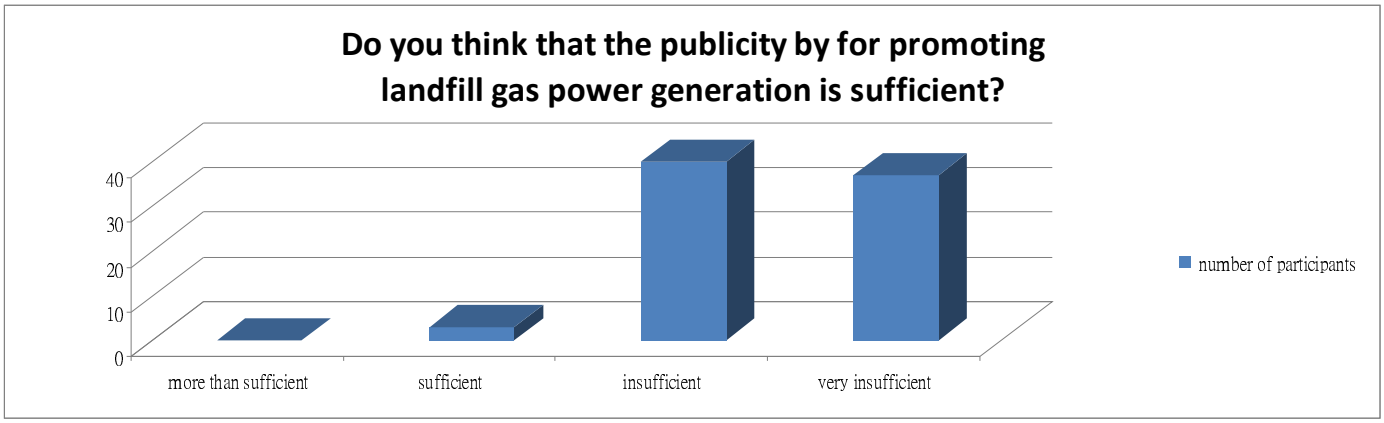



Do you think that landfill gas power generation is important?
50
40
30
20
10
0
important
not very important
not important
number of participants

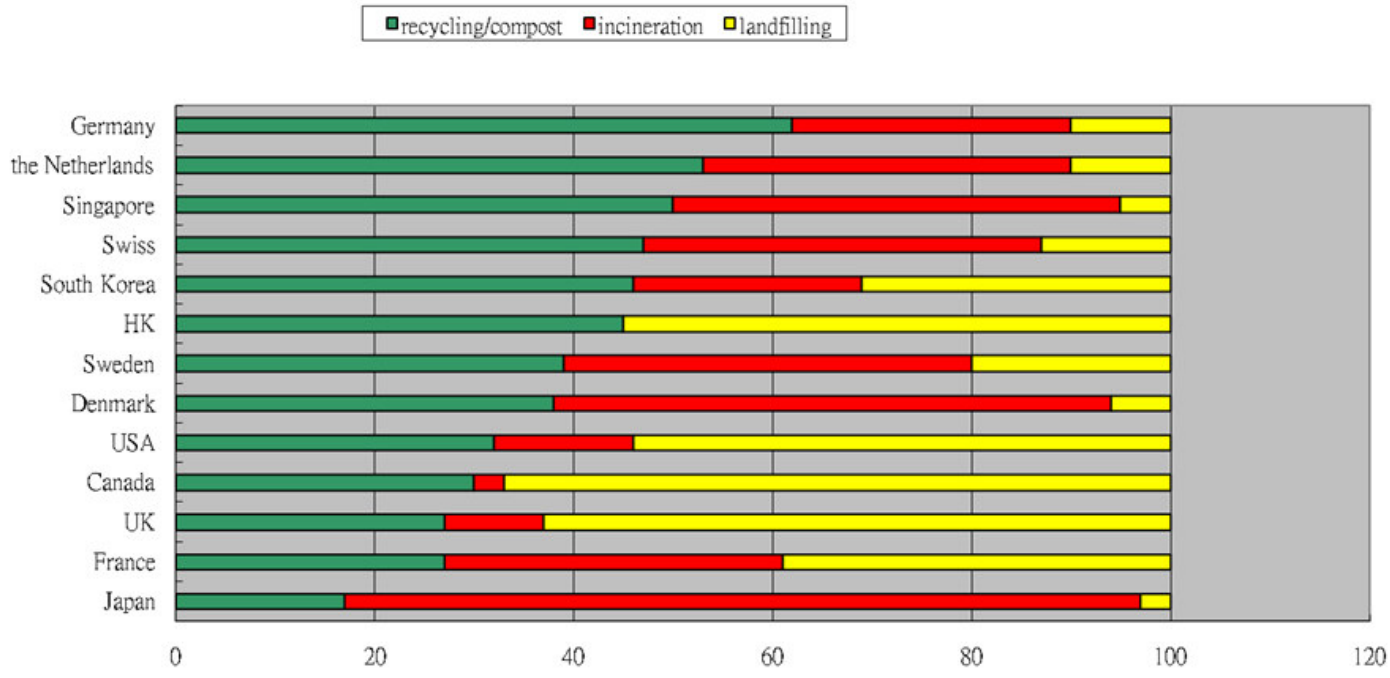

Do you think that promoting landfill gas power generation will have benefits?
50
40
30
20
10
0
benefits prevails disadvantages
neutral
disadvantages prevails benefits
number of participants


Do you think that promoting landfill gas power generation will have a obvious good result?
60
40
20
0
excellent result
obvious good result
neutral
good result is not obvious
number of participants


Do you support the government to promote landfill gas power generation?
40
20
0
support
neutral
do not support
number of participants


Do you think that the publicity by for promoting landfill gas power generation is sufficient?
40
30
20
10
0
more than sufficient
sufficient
insufficient
very insufficient
number of participants

Examples of how the other countries handle wastes



This is the end of our written report

Thank you for watching

Bye!