添付資料

1-2-2-A「EcoEthicsレポート」

CHARACTERISING HUMAN EXPOSURE TO LEAD IN INFORMAL SETTLEMENTS IN KENYA: A CASE-STUDY OF OWINO-UHURU SLUM, MOMBASA

Eco-Ethics International Union-Kenya, Mombasa

June, 2011

Introduction:

1.1 Background to problem:

Lead is a naturally occurring heavy metal that is toxic when ingested or inhaled by humans. It is argued that there is no safe exposure level for lead and blood lead levels (BLLs) below the WHO action level of 10 μg/dl can cause harm to human health (Helmenstine; Gavaghan 2002, 82). In the body, lead competes with essential metals such as iron, thus interfering with the production of haemoglobin and causing anaemia (Schwartz et al. 1990, 165). It is also absorbed and sequestered in the bone, and in old age or during pregnancy is rereleased into the blood (Environment Health Safety Online (EHSO) 2009). In children it causes neurological damage that is likely to be irreversible by preventing normal synapse in the nervous system from occurring (Savigny and Adam 2009, 22). Other effects of lead exposure in children as described by Savigny and Adam include decreased IQ levels, the risk of hypertension and possible immune dysfunction (2009, 22). In many U.S.A states, testing for blood lead is conducted for children up to the age of six which is when development is occurring in children and when behaviour such as crawling and pica is common. It is therefore the time period during which most exposure and damage to health is likely to occur (New York City Department of Health and Mental Hygiene 2009, 2).

There are two main ways through which people are exposed to lead- through environmental or occupational exposure. Environmental exposure occurs when lead that is already in the environment, such as from leaded petrol, leaded paint or leaded cans, contaminates gardens, soils, water or food in markets, and is ingested, inhaled or absorbed by the skin (Makokha et al. 2008, 349-351; Mwashote 2003, 32). Such exposure is usually in low doses and of a chronic nature. Even after lead was phased out in the 1980s in the U.S.A. for example; children in many parts have been found to have high levels of lead and especially in low-income areas of cities such as was reported in Boston, MA (Franco, 2001). In Zamfara, Nigeria informal gold refining released lead particles from the ore that found their way into the water, gardens and houses and caused many children's deaths (Blacksmith Institute 2011, 2). In Kenya, lead in petrol was present up to March of 2011 and possibly was phased out before then, after which observation of petrol stations indicates that they only retail unleaded fuels (Eco-Ethics International Union- Kenya 2011a, 1; Manyara 2010, 4). However, lead, being a conservative element, will remain in the environment for a long time as suggested by Filippelli et al (2005, 4). Occupational exposure on the other hand occurs when people involved in some occupations such as lead mining, lead refining and painting come into contact with lead while they work. In a neighbourhood in Dakar, Senegal where informal lead refining businesses were in operation in homes, 18 children died from acute lead poisoning and related causes in late 2008 (Häfliger et al. 2009, 1). In an informal working area of Nairobi, Njoroge et al found that the workers with highest blood lead levels were primarily in the spray painting, panel beating and electrical welding industries (2008, 286). Moreover, as has been found by Lin et al in their study of ceremonial powders and spices, certain culturally specific behaviour may increase people's exposure to lead (2010, 1). Mutuku et al

suggest that fasting or long periods without food increases lead absorption in the body by up to 90% (18).

1.2 Problem Statement:

A lead refinery factory in Owino-Uhuru slum, Mombasa wherein workers extract lead from used car batteries is a potential lead hotspot in the area. In 2009 three children from the slum were found to have high BLLs following constant bouts of faintness and general sickness, (23µg/dl, 12µg/dl and 17µg/dl) (Eco-Ethics International Union- Kenya and Penda 2009). A subsequent inspection of the factory was carried out after which it was revealed that the factory is poorly ventilated (Eco-Ethics International Union- Kenya 2011b, 1). It was also found that the workers in the factory have poor protection from lead dust from the batteries they were acquiring lead from. Few of them wore overalls or masks, likely as a result of the heat in the factory and it was unclear whether the recommended shower before they leave the premises was adhered to (Eco-Ethics International Union- Kenya 2011b, 1). The factory heads claimed that the emissions from the factory stacks were free from any lead since they were ran through a waste treatment plant and collected afterward for proper disposal (Eco-Ethics International Union- Kenya 2011b, 1). Previous interventions by Eco-Ethics International Union-Kenya have involved educational programmes for the residents of Owino-Uhuru on the dangers of lead and best practices for reducing exposure rather than on scientific study of the problem area. A full scientific exploration of the lead problem in the area has up to this point been beyond the capacity of the organisation and the residents.

1.3 Purpose of Research

Based on the problem stated the purpose of this study will be to conduct scientific research aimed at bridging this information gap. The research will take into consideration any culturally specific behaviour that may increase the residents' exposure to lead, such as fasting. This will make it possible for best practice recommendations to be made for both the residents of the area and the workers in the factory in order to reduce lead exposure.

1.4 Justification:

This research aimed at understanding the presence, knowledge and possible effects of lead in an informal residential setting such as Owino-Uhuru is. It will provide a tool for best practice recommendations aimed at reducing harmful exposure to lead amongst the residents and enhancing their health.

1.5 Objectives of the Research:

1. To assess the knowledge of among the residents of Owino-Uhuru on the harmful effects of lead on human health.
2. To find out what culturally specific behaviour may increase the residents' exposure to lead.

1.6 Hypothesis:

Ho: The residents of Owino-Uhuru are at high risk of lead exposure primarily from emissions from the nearby lead refinery.

2.0 Methodology

2.1 Geographic Location

The research was carried out in Owino-Uhuru an informal settlement about 7 km NW of Mombasa Island (Fig 1). The slum is situated in Mombasa County and lies between latitudes 4° 00’ 11.52” S and 4° 00’ 37.44” S and longitudes 39° 36’ 51.84” E and 39° 37’ 4.8” E.

Fig 1- Map of Owino-Uhuru. Map source, Google Earth.

2.2 Research Design:

2.2.1 Qualitative- Descriptive:

Three different types of questionnaires were developed and used to collect information from the residents of Owino-Uhuru.

2.3 Population and sample size

The research involved interviews with 29 respondents with the sample size dictated by the time and resource constraints of the study and the availability of respondents. The people interviewed were children and residents of Owino-Uhuru. Interviews with factory workers had been planned but it was not possible to find a satisfactory number of respondents.

2.4 Data collection instruments and procedures

Questionnaires for residents, children and factory workers were created and included questions on the residents' daily routine; food sources; any health complaints that might be attributable to lead; and the environmental issues they were aware of. The children's questionnaires targeted information concerning their play habits while the factory workers' questionnaires sought information on the factory's working conditions, the health of the workers and possible sources of the workers' to their families. The food section of the questionnaire was formatted along that used by Mutuku et al in determining lead exposure from food in Nairobi (Mutuku et al., 88-89).

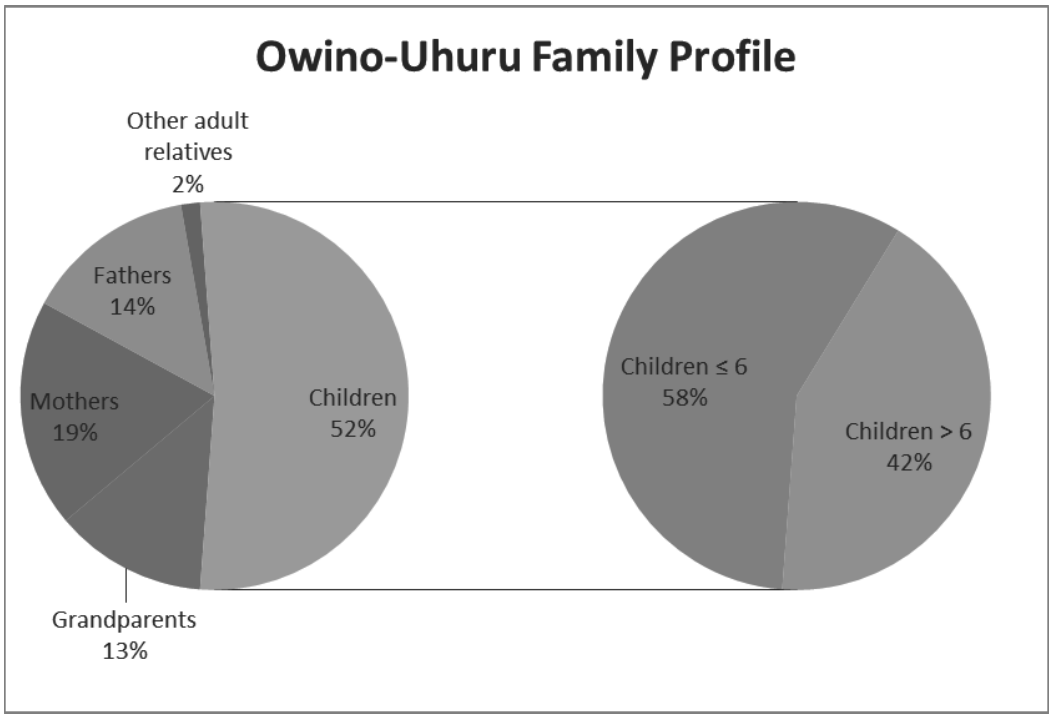
Interviews were conducted orally and in Kiswahili with randomly selected volunteer respondents on two separate days. The respondents lived in all parts of Owino-Uhuru to provide variation on the distance from the factory. The students who were interviewed were mainly students at a nursery school in Owino-Uhuru between the ages of 3 and 7. Additionally, observation was used to collect further data on respondents' behaviour.

2.5 Data analysis

The filled in questionnaires were analysed using Microsoft Excel to determine trends and behavioural characteristics that increased the likelihood of lead exposure among the different categories of respondents. Information obtained from observations was also used to reinforce the findings.

3.0 Results and Discussion

The general family set-up in Owino-Uhuru comprises one or both parents, a grandparent and other extended family members such as cousins and children both below 6 years old and above 6 years. In these families about 58% of the children are aged 6 years and below. Of the residents interviewed 36% was men and 64% was women. Besides the residents of Owino-Uhuru there is also a migratory population that comes to work in the slum every day and goes back to their homes in neighbouring residential areas. They too are at a risk of lead exposure even though less so than the residents.



3.1 Residents:

Most residents were aware of several environmental issues in Owino-Uhuru. 93% of the interviewees complained of smoke from the lead refinery factory. This indicates that the ambient smoke from the factory reaches all parts of the slum. Besides the smoke, 14% mentioned the dust from a cement factory in the vicinity. It seems however, that the cement factory might have moved and that this is no longer an issue. Another 21% mentioned the lack of sewage infrastructure as an issue in Owino-Uhuru. This, combined with the observations of some of the

residents that whenever it rained and ducks fed in the running water they often died, indicates that the open sewage with its potential to mix with lead in the soil is a hazard for domestic animals. 21% mentioned open rubbish disposal as an environmental issue.

The staple food in the area is *ugali* (solid cooked maize-meal) and a variety of vegetables that are obtained from kiosks within Owino-Uhuru. 79% of the residents obtained their vegetables from this source while 21% got theirs from gardens in the same area. It is highly likely that the ambient smoke from the factory deposits particles that are likely to contain lead on fruits as they lie in the kiosks. It was observed that in most kiosks however, the stall owners would clean and chop the vegetables (kale, cabbage) and pack these into plastic bags for sale. This indicates that there is a lowered risk from using these vegetables since they are sourced from Kongowea Market early in the day and don't lie in the open in Owino-Uhuru during the day when the factory's emissions are at their highest. Nevertheless, observation at several stalls indicated that the owners often used very little water to clean the vegetables and this became very dirty quickly. If this water were to be used to clean other fruits and vegetables during the day the risk of lead recontamination would be great. Vegetables sourced from the garden markets of Owino-Uhuru are likely to pose a lower risk of lead exposure as most of these gardens are located a considerable distance from the factory. Nonetheless, the residents living at this distance strongly complained of smoke issues making it likely that emissions would be deposited onto the gardens irrespective of the distance. A significant issue that has been recently highlighted in the newspapers is that the water by which many of these gardens grow might already be contaminated with lead from a number of factories in the area (Nation Correspondent 2011, 34; Swaleh 2011). It was ascertained during the reconnaissance of the area that the stream demarcating Owino-Uhuru's border contained the liquid waste from the lead factory. Furthermore it was reported that before this waste stream was re-routed from running through the slum it had been the cause of a number of livestock deaths. Lastly, 7% of the respondents reported that they picked their vegetables wherever they could find them in the area. The risk of lead exposure from this source would be the same as that from to the vegetables from the gardens. An additional exposure risk from the food is posed by the open cooking of food such as fish and chicken for sale. This food after it is cooked is displayed in the open or rudimentarily covered and is at risk of having particles fall onto it. The food available to the residents of Owino-Uhuru, therefore, increases their risk of lead exposure.

50% of the respondents reported that they fast at some point during the year for varying amounts of time including daily, monthly and periodically throughout the year. The reasons for fasting were included religious reasons, personal reasons and lack of food. Considering the rising inflation and prevailing drought conditions in Kenya and that some of the residents of Owino-Uhuru are very poor it is possible to posit that some of them go without food at some point (Bonyo 2011). Fasting therefore increases the risk of lead poisoning for Owino-Uhuru residents.

27% of the residents complained of headaches and while these might be linked to lead poisoning they might also be as a result of other things. The greatest percentage- 67%- complained of chest issues such as coughing, chest pain, sneezing and/or difficulty breathing as a result of the smoke issuing from the factory. Further research into the reactions involved in the extraction of lead in the factory will indicate the possible contents of the smoke and will provide insights into what might be causing the chest issues. Some of the health complications mentioned that might be linked to lead poisoning included reduced libido on the part of men which 40% of the men faced; excessive tiredness (6%); nausea, toothache, stomach ulcers and eye problems. Additionally, in speaking to the residents they highlighted other complaints registered in the area such as miscarriages amongst young women.

57% of the residents have heard of lead. Of this percentage, 75% know that lead can cause health problems. 29% of those who knew about lead and its harmful effects had found out through participating in training sessions with Eco-Ethics, an environmental NGO working on lead awareness in the area. The rest had possibly found out about lead from those who had been trained by Eco-Ethics. However, 57% of the interviewees still did not know of lead's harmful effects on health.

All of the residents who knew of lead's harmful effects had done something to prevent or reduce exposure with the most common response (38%) being to seek more information concerning lead. 25% of the respondents had participated in demonstrations at the factory while 13% had contributed to seeking dialogue with the factory authorities. A further 13% reported the matter to

the authorities. Finally, 13% of the respondents moved house to be at a greater distance from the factory in order to protect themselves and their families.

On questioning the residents about the possibility of there being a lead problem, 36% felt that there was a lead problem. All of them identified the source of lead as the lead refinery. Only 7% of those who knew of lead also felt that there was no lead problem in Owino-Uhuru. The greatest percentage was not aware of lead or its harmfulness and therefore could not comment on there being a problem or not. It was evident that the residents thought that the smoke issuing from the factory was bad. However, most of them did not connect the smoke with lead.

3.2 Children

Playing forms the major out-of-school activity for 92% of the children who live in Owino-Uhuru. Most children play outside of their houses in Owino-Uhuru in areas that are mostly bare earthed. The risk of lead exposure from lead contaminated dust and soil is likely to be greater for children whose houses are closer to the factory, however. 33% of the children reported playing at the Owino-Uhuru playground which is also bare earthed during their free time. Furthermore, it was mentioned that whenever the children find the school still closed in the morning or at lunchtime they play at the playground as they wait for it to be opened. About 42% of the children regularly played within 50 m of the factory either outside their homes or close to where their parents worked. Considering that from the family profile about 58% of the children are 6 years of age or less, the choice of where to play could pose a higher risk of lead poisoning. Observation in the school revealed evidence of pica as some of the children were sucking on their thumbs. This behaviour would occasion the transfer of any lead contaminated particles from the surfaces in the school into the child's mouth.

Fasting does not increase the lead exposure risk of the children in Owino-Uhuru. All the children interviewed were too young to fast. However, a risk might present itself if in their households there was no food and the children went hungry.

3.3 Factory Workers

Only two interviews were held with factory workers and from these it was possible to find out what type of work went on in the factory. One of the workers was currently employed at the factory while the second one had been previously employed. The two were male.

The factory works in three 8 hour long rotational shifts with each worker working on one for a week before moving to the next. The casual labourers employed at the factory split open the batteries once they come in and the rest of the workers proceed to extract the lead through chemical means. The mixture thy use comprises Magadi soda, charcoal and the lead derived from the batteries. After the chemical reaction has occurred in the kiln, the workers separate the clean lead from the slag. It was unclear how the slag was disposed of although one mentioned that they were disposed of in non-residential areas. The plastic parts of the batteries were sold to other companies.

One of the workers mentioned that protective gear was usually hard to get even when they put in requests. The second worker, however, mentioned that he received boots, mask, helmet and overall and put these on every day before beginning work. Additionally he mentioned that the workers have two options for cleaning their protective gear- they can either have their gear washed at the factory or take it home with them to have it washed from there. Moreover, the worker mentioned that the factory regulations make it mandatory for the workers to take a shower before they leave and gives them a 500ml packet of milk each at the end of their shifts.

4.0 Conclusion

Many of the residents of Owino-Uhuru fast during the year and obtain their food from sources that are likely to be contaminated by ambient lead particles in the factory smoke. The children in Owino-Uhuru are mostly below the age of six and play in areas that are bare-earthed. Some of them exhibit pica behaviour. Based on previous reports of lead poisoning of livestock and children in Owino-Uhuru and the current data on food sources and fasting and play habits, the residents of Owino-Uhuru are at risk of lead exposure from the nearby lead refining factory. Many of them are unaware, however, of their risk of lead exposure or its harmfulness to their health.

5.0 Recommendations

From the findings of the research, the residents of Owino-Uhuru have been found to have little knowledge of lead or its potential to cause harm to human health and they therefore cannot do much to reduce their exposure. As such the following should be done to reduce their risk of exposure.

1. More intense efforts at education and capacity building of all the residents should be conducted with an emphasis on using all available sources of information.
2. Elaborate interviews with the factory workers should be conducted to determine if they are at risk and to establish what other emissions might be issuing from the factory.
3. Reasonable measures to reduce lead exposure such as watering of dusty areas, thorough cleansing of vegetables and avoiding pica should be suggested to the residents of Owino-Uhuru.

6.0 References

Blacksmith Institute. 2011. *Zamfara, Nigeria Lead Poisoning Crisis*. Project Completion Report. Zamfara, Nigeria: Blacksmith Institute. http://www.blacksmithinstitute.org/nigerian-lead-poisoning-crisis-blacksmith-report.html.

Bonyo, J. 2011. "High prices to push inflation past 20 per cent mark." *Daily Nation*, July 7, sec. Business News. http://www.nation.co.ke/business/news/High+prices+to+push+inflation+past+20+per+cent+mark/-/1006/1196196/-/kdjn0hz/-/index.html.

Eco-Ethics International Union- Kenya. 2011a. *International SAICM Implementation Project (ISIP)- Report for Lead/Lead in Paint Project.* Mombasa, Kenya: Eco-Ethics International Union-Kenya, March.

———. 2011b. *An Inspection at the Metal Refinery EPZ Limited Company Premises (Mombasa)*. Mombasa, Kenya: Eco-Ethics International Union- Kenya, April 13.

Eco-Ethics International Union- Kenya, and Agnes Penda. 2009. *The Silent Killer*. PGU. Mombasa, Kenya.

Environment Health Safety Online (EHSO). 2009. Lead-XRF - History of Lead in Bone. *Lead and Your Health*. March 8. http://www.ehso.com/ehshome/hmlead.htm.

Filippelli, Gabriel M., Mark A.S. Laidlaw, Jennifer C. Latimer, and Robyn Raftis. 2005. "Urban Lead Poisoning and Medical Geology: An Unfinished Story." *GSA Today* 15 (1): 4. doi:10.1130/1052-5173(2005)015<4:ULPAMG>2.0.CO;2.

Franco, S. 2001. *Trends in Blood Lead Levels Among Children --- Boston, Massachusetts, 1994--1999*. Weekly. Morbidity and Mortality Weekly Report. Boston, USA: Center for Disease Control, May 4. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5017a3.htm.

Gavaghan, Helen. 2002. "Lead, unsafe at any level." *Bull World Health Organ* 80 (1): 82. doi:10.1590/S0042-96862002000100022.

Helmenstine, Anne Marie. What Makes Lead Poisonous? *About.com Chemistry*. http://chemistry.about.com/od/howthingsworkfaqs/f/leadpoisoning.htm.

Häfliger, Pascal, Monique Mathieu-Nolf, Stephanie Lociciro, Cheikh Ndiaye, Malang Coly, Amadou Diouf, Absa Lam Faye, et al. 2009. "Mass Lead Intoxication from Informal Used Lead-Acid Battery Recycling in Dakar, Senegal" 117 (10) (October): 1535-1540. doi:10.1289/ehp.0900696.

Lin, Cristiane Gurgel, Laurel Anne Schaider, Daniel Joseph Brabander, and Alan David Woolf. 2010. "Pediatric Lead Exposure From Imported Indian Spices and Cultural Powders." *Pediatrics* 125 (4) (April 1): e828 -e835. doi:10.1542/peds.2009-1396.

Makokha, A. O, L. R Mghweno, H. S Magoha, A. Nakajugo, and J. M Wekesa. 2008. "Environmental lead pollution and contamination in food around Lake Victoria, Kisumu, Kenya." *African Journal of Environmental Science and Technology* 2 (10): 349–353.

Manyara, Wanjiku. 2010. "Kenya Progress Towards Cleaner Fuels." *Petroleum Insight*, September.

Mutuku, J.M., A. O Makokha, G.M. Kenji, F.M. Mathooko, D.M. Maina, and P. Wanyoro. *A Report on Lead Levels in Soil, Water and Food and its Effects on Subjects Living in Highly Industrialised Areas of Kenya*. Kenya.

Mwashote, B. M. 2003. "Levels of cadmium and lead in water, sediments and selected fish species in Mombasa, Kenya."

Nation Correspondent. 2011. "Alarm Raised as Toxic Waste Dumped in Residential Area." *Daily Nation*, June 21, sec. Provincial.

New York City Department of Health and Mental Hygiene. 2009. “Lead Poisoning: Prevention, Identification, and Management.” *City Health Information* 28 (3) (May): 10.

Njoroge, G K, E N M Njagi, G O Orinda, C B Sekadde-Kigondu, and J K Kayima. 2008. “Environmental and occupational exposure to lead.” *East African Medical Journal* 85 (6) (June): 284-291.

Savigny, D., and T. Adam. 2009. “Systems thinking for health systems strengthening/edited by Don de Savigny and Taghreed Adam.”

Schwartz, Joel, Philip J Landrigan, Edward L (Jr) Baker, Walter A Orenstein, and Ian H von Lindern. 1990. “Lead-Induced Anemia: Dose-Response Relationships and Evidence for a Threshold.” *American Journal of Public Health* 80 (2): 165-168.

Swaleh, Saida. 2011. Lead Dumping Abortion Saga. *KTN Leo*. Mombasa, Kenya: KTN, June 19. http://www.youtube.com/user/standardgroupkenya#p/u/636/dVI5JprqxEo.

7.0 Appendix

Questionnaire for Children

1. How old are you?
2. Which class/form are you in?
3. Do you live close to the factory/the main road? How close?
4. Who do you live with?
5. When do you go to school? When do you leave in the evening?
6. What do you do when you're not in school?
    a. Plays b. Helps with chores at home c. Other (specify)
        a. If they play→ where do you play?
        b. How often do you play here?
        c. How far is this from the factory?
        d. If different activity→ where do you carry this out?
        e. How often do you do this?
        f. How far is this from the factory?
7. With whom do you play? By yourself or with others?
8. When are your school holidays?
9. What do you do when you are on holiday?
10. Do you fast at any point during the year?
        a. If yes→ When and for how long?

Questionnaire for Factory Workers (current and previous)

1. How old are you?
2. Where do you live? How far is your home from the factory?
3. Do you currently work in the lead refinery factory?
    a. When did you work there?
4. How many days a week do/did you work there?
5. When does/did your day begin? When does/did it end?
6. How long have you been working/did you work in the lead refinery factory?
    a. Why did you stop working in the factory?
7. Where did you work before that?
8. Describe your daily routine at work.

9. Where do the batteries you work with come from?
10. Are you in physical contact with the batteries?
11. Do you wear gloves when you work? Mask/overall?
12. How many batteries can you process in a day?
13. Is this normal below or above the expected amount?
14. Have you had any health complications since you began working/while you worked at the factory?

1. Are you aware of that lead has harmful effects on health?
2. Have you done anything to protect yourself from lead?
    a. If yes→ what?

b. If no→ why not?

3. In your opinion is there a lead problem in Owino-Uhuru?
4. In your opinion what is the source of the lead in Owino-Uhuru?
5. Do/Did you take a shower before you leave for home?
6. Do/Did you have young children at home?
7. How many? What ages are they?
8. Are you the primary caregiver of the child(ren)?
9. Do you work at the factory while you fast?
    a. If female, did you work at the factory while you were pregnant?

Questionnaire for Owino-Uhuru Residents

1. How old are you?
2. How far from the factory do you live?
3. How long have you lived in Owino-Uhuru?
4. When was your house constructed?
5. Are there any environmental issues you are aware of in Owino-Uhuru?
6. Do you currently have a job? Where?
7. Describe your daily activities from when you wake up in brief?

8. Where do you spend your free time such as on weekends?
9. What do you eat the most during the week/ what is your staple food?

10. Where do you get your food from?
    a. Farm b. Market c. Aid d. Other (specify)
11. Where do you buy your fruits and vegetables from?
    a. Road-side b. Local kiosk c. Market d. Supermarket e. Other (specify)

12. Where do you get your milk from?
    a. Shop (packet) b. Shop (unpacketed) c. Domestic production d. Other (specify)
13. Where do you get your water from?
    a. Piped b. Other source (specify)

14. Do you fast at any point during the year?
15. How often and for how long?
16. Have you had any health complications since you began living in Owino-Uhuru?
17. Do you know of the metal lead?
18. Are you aware that it has harmful effects on health?
19. Have you done anything to protect yourself from lead?
    a. If yes→ what?
    b. If no→ why not?
20. In your opinion is there a lead problem in Owino-Uhuru?
21. In your opinion what is the source of the lead in Owino-Uhuru?
22. Do you live by yourself? Do you have children in the house?
    a. If yes→ How many? What ages?
23. Are you their primary care-giver?

2-4-3-A「リサイクル完了証明書サンプル」

リサイクル完了証明書

平成　　24　年　　月　　日

御中

受託者
宮城県栗原市鶯沢南郷荒町48
細倉金属鉱業株式会社
TEL　0228-55-3111
FAX　0228-55-3078

社印

下記受託業務は平成　　年　　月　　日に処理完了しましたので御報告致します。

1. 受託業務名　　鉛蓄電池処理(鉛製錬原料)

2. 品名　　廃鉛蓄電池

3. 納入業者　　エバーグリーン株式会社

4. 数量　　11,997kg

5. 集荷日　　平成 24　年　　6 月　　21 日

6. 納入月日　　平成 24　年　　6 月　　22 日

7. 処理月日　　平成　　年　　月　　日

2-4-8-A「ケニア事業計画」

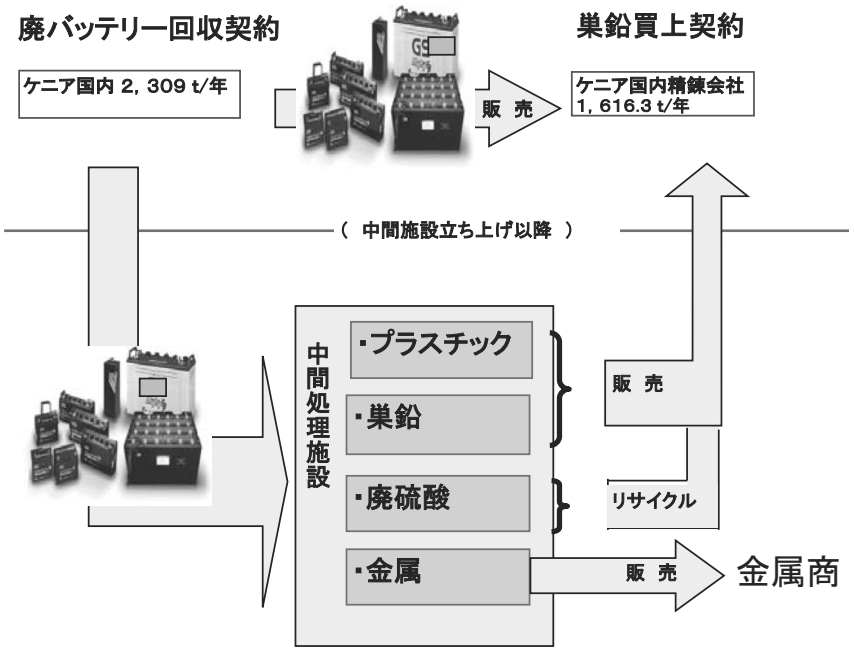
事　業　計　画

2014年2月18日

環境企業のゼロエミッションパートナー

エバーグリーン株式会社

平成26年度： 中間処理施設の立ち上げ



当社のねらいは25年10月廃バッテリーの適正リサイクルにより、再生鉛資源の確保及び希硫酸のリサイクル処理に伴う環境破壊の改善

現　在　**現地で人手により解体を行い、希硫酸処理は行われていない。また、鉛処理についても、土壌に悪影響を及ぼしている。**

地域活性化の貢献

処理工場新規増員 15名

地元企業との業務のマッチングと連携・環境破壊の防止

・運送会社

・設備会社

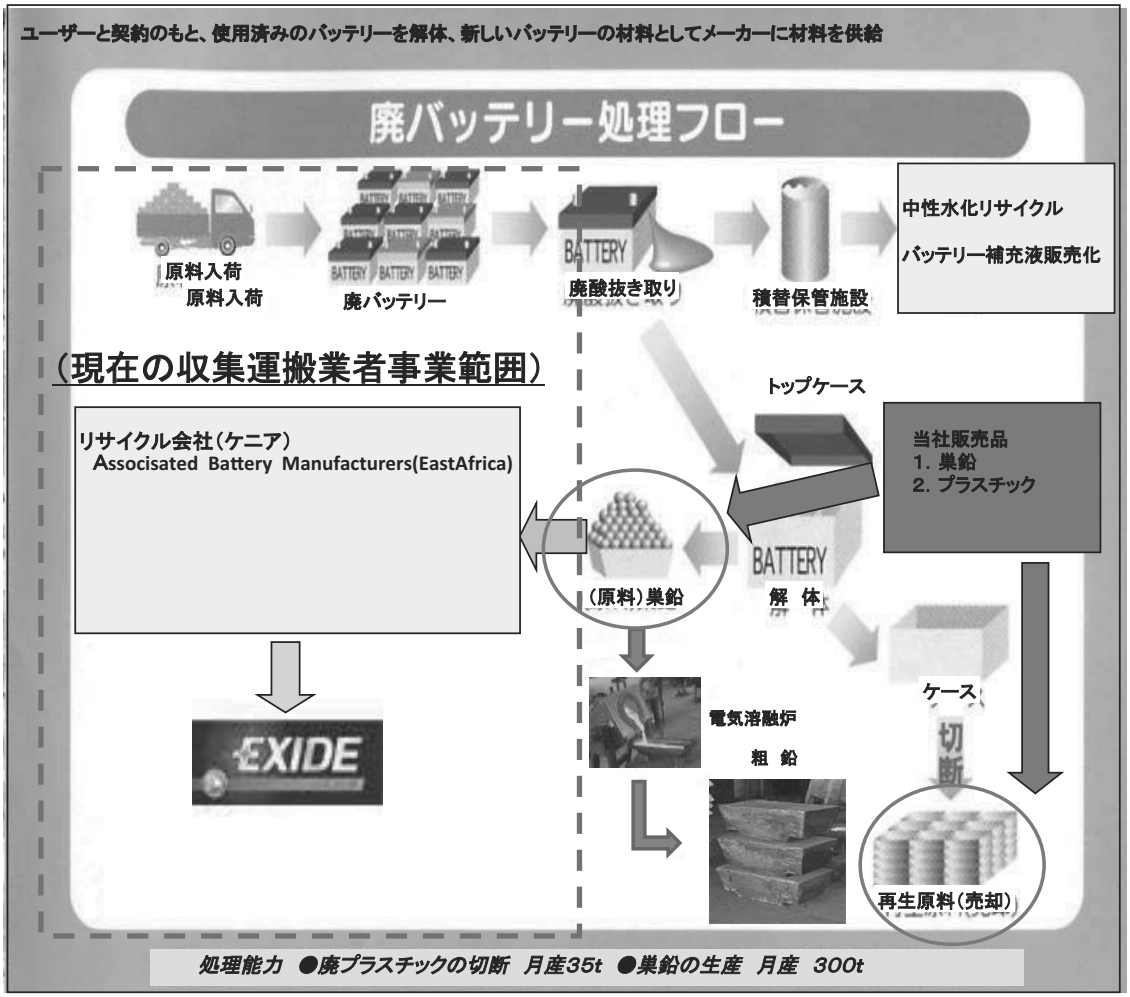
・産廃収集運搬業者・産廃処理業者・自動車解体業者

ガソリンスタンド

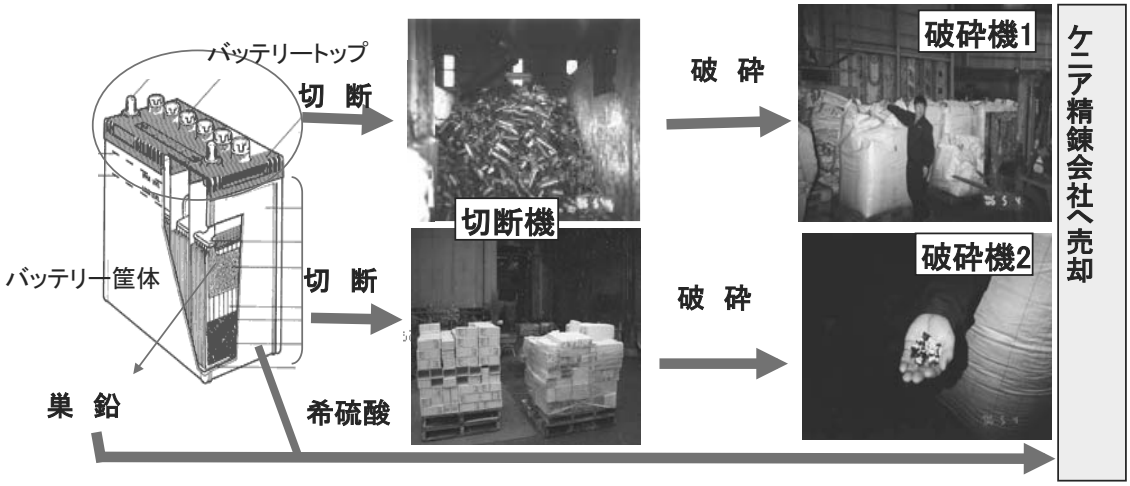
・政府省庁など

中間処理新規事業計画

ケニア計画施設の処理概要



中間処理施設の意義と工程による売上単価の変化



自動車保有台数からの廃バッテリー発生量の推定

ケニア保有車両台数122.85万台
バッテリー保有量は153.9万個
4年に一回の取替において発生量
153.9万個÷4年＝38.47万個
（1年間で発生する量）

推定根拠となるデータ

＜アフリカ各国の自動車保有台数＞　　（単位　1,000台）

国（地域）	年次	自動車（四輪以上）	乗用車	バス	貨物車	二輪車	1,000人当たり自動車数（台）
アルジェリア	2006年	3,264	2,043	55	1,166	10	98
ウガンダ	2007年	201	81	40	79	177	7
エジプト	2006年	3,163	2,372	79	712	751	40
エチオピア	2007年	237	71	17	149	7	3
ケニア	2007年	793	562	20	211	181	21
ジンバブエ	2007年	1,416	1,214	16	187	109	106
セネガル	2007年	253	188	14	51	11	20
チュニジア	2007年	1,057	747	10	301	5	103
ボツワナ	2007年	214	105	10	99	3	113
南アフリカ	2007年	7,603	5,161	317	2,126	312	159

出典：総務省統計局「世界の統計　2010」

＜2007年以降の自動車保有台数の推定＞

車種	新規自動車登録台数の実績値				過去の伸び率から推測		
	2008年	2009年	2010年	2011年	2012年	2013年	2014年
乗用車	18,686	16,930	16,165	11,026	7,181	3,190	923
ステーションワゴン	24,747	27,599	37,553	31,199	35,269	33,123	35,166
パネルバンなど	8,983	7,120	6,975	7,442	7,779	8,675	10,112
貨物自動車/トラック	6,691	6,037	4,924	5,247	4,560	4,224	3,400
バス/コーチ	1,243	1,057	1,264	1,662	2,613	5,403	17,564
小型バス	5,206	4,483	3,600	451	45	1	0
トレーラー	2,100	2,883	2,379	2,556	2,266	2,159	1,823
トラクター	1,262	1,115	1,161	1,179	1,247	1,339	1,520
二輪三輪自動車を除く合計	68,918	67,224	74,021	60,762	60,960	58,112	70,507

出展：

＜複数個のバッテリーを排出する車種の反映＞

車種	-2007年	2008年-2014年	保有台数合計	バッテリー発生数合計	
乗用車、ステーションワゴン、パネルバンなど	562,000	355,841	917,841	917,841	12Vの為1台にバッテリー1個搭載
貨物自動車/トラック	211,000	35,083	246,083	492,166	12Vの為1台にバッテリー1個搭載
バス/コーチ	20,000	30,806	50,806	101,612	12Vの為1台にバッテリー1個搭載
小型バス	0	13,786	13,786	27,572	12Vの為1台にバッテリー1個搭載
現在における合計台数			1,228,516　台	**1,539,191**　個	

ケニアにおける廃蓄電池の想定数

自動車からのバッテリー	***384,750***	個
合　計	384,750	個

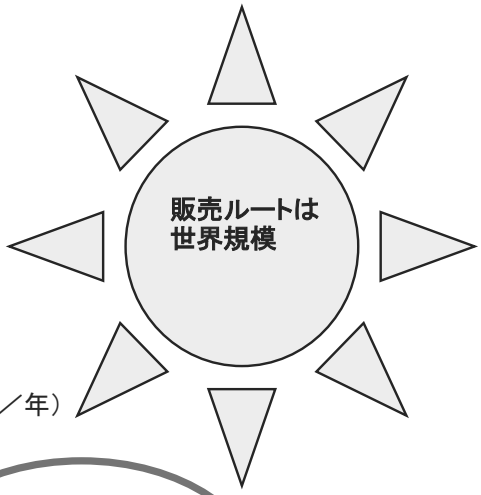
（通常動作中の車両の交換用の廃バッテリー）

当社における廃蓄電池の計画値

			計画シェア
自動車からのバッテリー	***153,900***	個	**40%**
合　計	153,900	個	**40%**

（個／年）

100 %



廃蓄電池の平均重量	15	kg/個
廃蓄電池の年間重量	2,309	t/年
廃蓄電池の月間重量	192	t/月
外注費　廃棄物処理	**0**	千円／年
搬入費用	**0**	千円／年
費用合計	0	千円／年

廃電池収入	
405,834	千円/年
33,820	千円/月

年間処理重量

2,309 ***t***

月間処理重量

192.4 *t*

回収業者からの
買取単価（77円/kg）

廃蓄電池一個当たりの構成及び費用

			構成比	販売単価		販売価格
希硫酸	***1.5***	kg	10%	0	円/kg	0
巣鉛	***12.0***	kg	80%	116	円/kg	1392
廃プラスチック	***1.5***	kg	10%	60	円/kg	90
その他	***0.0***	kg	0%	0	円/kg	0
業者受入費用	***15.0***	kg	100%	77	円/kg	1155
廃棄物　（希硫酸）	***1.5***	kg	10%	0	円/kg	0
合　計	15	kg	100%		円/kg	2637

MACHAKOS中間処理施設における

生産計画と損益計画

計画数（廃バッテリーのみの売上計画数）

処理量/1日	*8*	トン	829 千円
処理量/1月	*192*	トン	19,007 千円

採算分岐計画数（経費合計を廃バッテリーでカバーした場合の損益分岐点）

処理量/1日	*7*	トン	934 千円
処理量/月	*153*	トン	21,398 千円

環境企業のゼロエミッションパートナー

エバーグリーン株式会社

計画ー1

事 業 計 画

1 計画工場敷地面積	1,650	㎡
2 工事期間	3	ヶ月
3 総事業費	*70,512*	千円
○創 業 費	2,580	千円
○建 設 費	47,932	千円
○所要資金	20,000	千円

所用資金内訳

区 分	金 額	内 訳		
創 業 費	*2,580*	地元対策費	0	説明会
		設計費	1,000	企画設計、申請
		事務費	130	開業迄の交渉計画等
		事務所備品	500	事務機、分析機器含む
		運転資金	550	操業年度の人件費など
		事務所賃貸料	400	
建 設 費	*47,932*	廃バッテリー解体設備	13,549	
		PH中和処理装置機械設備	10,083	
	税込み価格 *50,329*	空調機	1,500	
		破砕機	2,000	
		トラックスケール	2,300	
		建屋建築費	5,000	
		設備工事費	2,000	
		電気工事費	3,000	
		事務所設置工事費	1,500	
		倉庫建築費	2,000	
		外構工事費	2,000	
		監視カメラ設置費	1,000	
		仮設工事費	2,000	
		土地購入代	0	
所要資金	*20,000*	通常運転資金	20,000	
合 計	*70,512*			

資金調達(長期借入) (単位:千円)

総工費	70,512	
返済方法	2 年据置 15 年均等返済	
金利	1.90%	
資金内訳		
融資金額	銀行融資資金創業+建設	50,512
所要資金		20,000
金額合計	社長自己資金	70,512

資本金	・現在の資本金	10,000
	・資本金増資予定金額	0
	・その他	0
計画資本金合計		*10,000*

借入金返済額

	借入返済金	借入残金
25年度	0	50,512
26年度	0	50,512
27年度	3,535	47,145
28年度	3,535	43,778
29年度	3,535	40,411
30年度	3,535	37,044
31年度	3,535	33,677
32年度	3,535	30,310
33年度	3,535	26,943
34年度	3,535	23,576
35年度	3,535	20,209
36年度	3,535	16,842
37年度	3,535	13,475
38年度	3,535	10,108
39年度	3,535	6,741
40年度	3,535	3,374
41年度	3,535	7

収支計画の算定基準(1)

1.収入の部

1)計算基準

○解体処理機1日操業時間	8	時間操業
○1年操業日数	275	日

○廃バッテリー解体処理

廃バッテリー解体台数　559.6 台/日　X　275 日/年　＝　153,900 台

管内獲得シェア　40%　　1台当たり重量　0.015 t

○回収資源

	構成比	kg/1台	単価(円/kg)	年間重量(t)	年間金額 (千円)
希硫酸	10.0%	1.5	0	230.9	0
鉛	80.0%	12.0	116	1,846.8	214,229
廃プラスチック	10.0%	1.5	60	230.9	13,851
その他	0.0%	0.0	0	0.0	0
廃棄物	10.0%	1.5	0	230.9	0
合　計	100.0%	15.0	140	2,308.5	228,080
					228,080

1)収入計画金額　(単位:千円)

				一日間	月間	年間
事業	廃バッテリー処理業			829	19,007	228,080
	合　計			829	19,007	*228,080*

事業収支試算表 （単位：千円）

カテゴリ				初年度	1年目	2年目	3年目	4年目	5年目	6年目	7年目	8年目	9年目	10年目	11年目	12年目	13年目	14年目	15年目
収				**70%**	**80%**	**100%**	**110%**	**120%**	**130%**	**140%**	**150%**	**150%**	**155%**	**160%**	**160%**	**165%**	**165%**	**170%**	**170%**
入	年間収入			***159,656***	***182,464***	***228,080***	***250,888***	***273,696***	***296,504***	***319,312***	***342,120***	***342,120***	***353,524***	***364,928***	***364,928***	***376,332***	***376,332***	***387,736***	***387,736***
支出の部	電力費			2,317	2,317	2,317	2,317	2,317	2,317	2,317	2,317	2,317	2,317	2,317	2,317	2,317	2,317	2,317	2,317
	用水費			370	528	660	660	660	660	660	660	660	660	660	660	660	660	660	660
	リフト燃料、油脂費			862	1,232	1,540	1,694	1,848	2,002	2,156	2,310	2,310	2,387	2,464	2,464	2,541	2,541	2,618	2,618
	仕入原価費			124,428	142,204	177,755	195,530	213,305	231,081	248,856	266,632	266,632	275,519	284,407	284,407	293,295	293,295	302,183	302,183
	薬品費			1,935	2,765	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456
	燃料費			1,344	1,920	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
	保全・修繕費			2,100	2,400	3,000	2,400	2,400	5,000	2,400	2,400	2,400	2,400	7,000	2,400	2,400	2,400	2,400	10,000
	労務費			6,300	7,200	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000
	地代家賃			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	残渣処理費			2,100	2,400	3,000	3,300	3,600	3,900	4,200	4,500	4,500	4,650	4,800	4,800	4,950	4,950	5,100	5,100
	人件費			3,500	3,640	3,786	3,937	4,095	4,258	4,429	4,606	4,790	4,982	5,181	5,388	5,604	5,828	6,061	6,303
	役員報酬			8,000	8,000	10,000	11,000	12,000	13,000	14,000	15,000	15,000	15,500	16,000	16,000	16,500	16,500	17,000	17,000
	福利厚生費			368	525	568	591	614	639	664	691	718	747	777	808	841	874	909	945
	旅費交通費			1,680	1,920	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
	交際接待費			490	560	700	700	700	700	700	700	700	700	700	700	700	700	700	700
	広告宣伝費			420	480	600	600	600	600	600	600	600	600	600	600	600	600	600	600
	印刷費			350	400	500	500	500	500	500	500	500	500	500	500	500	500	500	500
	水道光熱費			350	400	500	500	500	500	500	500	500	500	500	500	500	500	500	500
	通信費			420	480	600	600	600	600	600	600	600	600	600	600	600	600	600	600
	建物保険料			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	事務用品費			420	480	600	600	600	600	600	600	600	600	600	600	600	600	600	600
	会費会議費			420	480	600	600	600	600	600	600	600	600	600	600	600	600	600	600
	修繕費			350	400	500	500	500	500	500	500	500	500	500	500	500	500	500	500
	燃料費			350	400	500	500	500	500	500	500	500	500	500	500	500	500	500	500
	雑　　費			70	80	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	合　　計			***158,944***	***181,210***	***225,081***	***243,885***	***263,295***	***285,313***	***302,138***	***321,571***	***321,783***	***331,618***	***346,062***	***341,701***	***351,563***	***351,821***	***361,704***	***369,582***
資金の部	営業利益			712	1,253	2,999	7,003	10,401	11,191	17,174	20,548	20,336	21,905	18,865	23,227	24,769	24,511	26,032	18,153
	営業外収入			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	補助金等																		
	営業収益計			712	1,253	2,999	7,003	10,401	11,191	17,174	20,548	20,336	21,905	18,865	23,227	24,769	24,511	26,032	18,153
	支払金利長期			0	0	168	168	168	168	168	168	168	168	168	168	168	168	168	168
	経常利益			712	1,253	2,831	6,835	10,233	11,023	17,006	20,380	20,168	21,737	18,697	23,059	24,601	24,343	25,864	17,985
	課税			214	376	849	2,051	3,070	3,307	5,102	6,114	6,051	6,521	5,609	6,918	7,380	7,303	7,759	5,396
		建屋設備費借入返済額																	
	当期利益			**498**	**877**	**1,982**	**4,785**	**7,163**	**7,716**	**11,904**	**14,266**	**14,118**	**15,216**	**13,088**	**16,141**	**17,220**	**17,040**	**18,105**	**12,590**
	前期繰越利益			0	498	1,376	3,357	8,142	15,305	23,021	34,925	49,191	63,309	78,525	91,613	107,755	124,975	142,015	160,120
	未処分利益			498	1,376	3,357	8,142	15,305	23,021	34,925	49,191	63,309	78,525	91,613	107,755	124,975	142,015	160,120	172,710
	資金源泉			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	長期借入金返済			0	0	3,367	3,367	3,367	3,367	3,367	3,367	3,367	3,367	3,367	3,367	3,367	3,367	3,367	3,367
	過不足			498	1,874	−10	4,775	11,938	19,654	31,558	45,824	59,942	75,158	88,246	104,388	121,608	138,648	156,753	169,343
	キャシュフロー			498	1,874	−10	4,775	11,938	19,654	31,558	45,824	59,942	75,158	88,246	104,388	121,608	138,648	156,753	169,343
	長期期末借入残			50,512	50,512	47,145	43,778	40,411	37,044	33,677	30,310	26,943	23,576	20,209	16,842	13,475	10,108	6,741	3,374

施設稼働率＝処理単価変動推移とする。

収支計画の算定基準(2)

2.支出の部

1)施設管理費　　(単位:千円)

カテゴリ	単価(円)	処理/使用量		1日	年間	処理単価	備考
電力費計					*1,272*		
稼働日	5	100	kw	103	1,233		実負荷 70% 275 日/年
休業日	5	5	kw	3.3	39		90 日/年
水道料計					*660*		
稼働日	10	30	m^3/h	2400.0	660		
休業日	0	1	m^3/h		0		
車両費							
燃料、油脂代	70	40	ﾘｯﾄﾙ/日	5.6	*1,540*		2 台分
油脂費計	200	0	ﾘｯﾄﾙ/月		*0*		グリース・潤滑油
薬品費計					*3,456*		苛性ソーダ、他
苛性ソーダ	120	10	kg/h	9.6	3,456		
消石灰等	71	0	kg/h	0.0	0		
				0.0			
燃料費計				0.0	*2,400*		軽油
	60	100	kg/h	48.0	2,400		
保全・修繕費					*3,000*		
労務費計					*9,000*		
廃バッテリー処理	600	15	人		9,000		
排ガス測定費					*0*		
残渣処理費					*0*		
仕入原価費					177,755		
地代家賃	0				0		
合　計					*199,083*		

工場作業員 15人

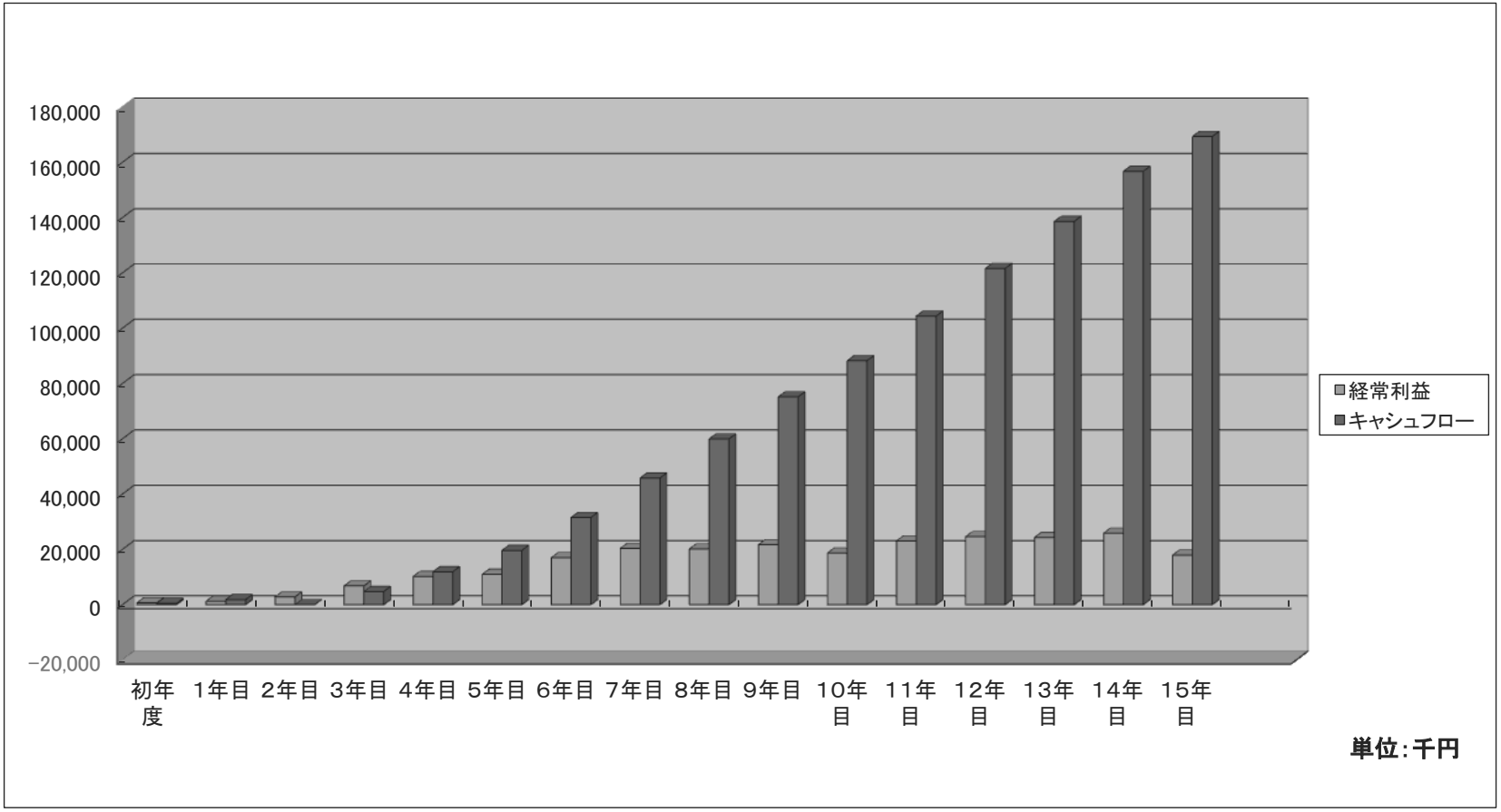
1.廃バッテリー収集運搬受入費 60円/kg

2)一般管理費及び経費　　(単位:千円)

カテゴリ	内容	年間費用	処理単価	備考
事務所人件費	1 名 1,500 千円/年 2 名 1,000 千円/年	3,500		毎年 4% 増加
法定内外福利厚生費	人件費の15%として計算	525		掛率 15%
旅費交通費	営業活動を主体とした旅費	2,400		
交際接待費	来客等	1,000		税引当金に 50% 組込
広告宣伝費	事業案内・ホームページ等	600		
印刷費	研究資料他・営業・業務用	500		
水道光熱費	施設管理費より算入	500		
通信費	電話代・郵送料	600		
建物他保険料	建物火災・災害等保険掛捨て	0		
事務用品費	書類帳簿・文章用書類等	600		
会費、会議費	同業者会費・運営委員会他	600		
修繕費	営業車、備品等の修繕費	200		
燃料費	営業用ガソリン代	500		
雑費	消耗品・手数料・調査費等	100		
合　計		*11,625*		

210,708	

キャシュフロー(新規中間処理施設)



	初年度	1年目	2年目	3年目	4年目	5年目	6年目	7年目	8年目	9年目	10年目	11年目	12年目	13年目	14年目	15年目
経常利益	712	1,253	2,831	6,835	10,233	11,023	17,006	20,380	20,168	21,737	18,697	23,059	24,601	24,343	25,864	17,985
キャシュフロー	498	1,874	−10	4,775	11,938	19,654	31,558	45,824	59,942	75,158	88,246	104,388	121,608	138,648	156,753	169,343

事業収支試算表 （単位：千円）

カテゴリ				初年度	1年目	2年目	3年目	4年目	5年目	6年目	7年目	8年目	9年目	10年目	11年目	12年目	13年目	14年目	15年目
収				**70%**	**80%**	**100%**	**110%**	**120%**	**130%**	**140%**	**150%**	**150%**	**155%**	**160%**	**160%**	**165%**	**165%**	**170%**	**170%**
入	年間収入																		
	電力費			2,317	2,317	2,317	2,317	2,317	2,317	2,317	2,317	2,317	2,317	2,317	2,317	2,317	2,317	2,317	2,317
	用水費			370	528	660	660	660	660	660	660	660	660	660	660	660	660	660	660
	リフト燃料、油脂費			862	1,232	1,540	1,694	1,848	2,002	2,156	2,310	2,310	2,387	2,464	2,464	2,541	2,541	2,618	2,618
	仕入原価費																		
	薬品費			1,935	2,765	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456
	燃料費			1,344	1,920	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
	保全・修繕費			2,100	2,400	3,000	2,400	2,400	5,000	2,400	2,400	2,400	2,400	7,000	2,400	2,400	2,400	2,400	10,000
	労務費			6,300	7,200	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000
	地代家賃			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
支	残渣処理費			2,100	2,400	3,000	3,300	3,600	3,900	4,200	4,500	4,500	4,650	4,800	4,800	4,950	4,950	5,100	5,100
	人件費			3,500	3,640	3,786	3,937	4,095	4,258	4,429	4,606	4,790	4,982	5,181	5,388	5,604	5,828	6,061	6,303
	役員報酬																		
出	福利厚生費			368	525	568	591	614	639	664	691	718	747	777	808	841	874	909	945
	旅費交通費																		
	交際接待費			490	560	700	700	700	700	700	700	700	700	700	700	700	700	700	700
	広告宣伝費																		
の	印刷費			350	400	500	500	500	500	500	500	500	500	500	500	500	500	500	500
	水道光熱費			350	400	500	500	500	500	500	500	500	500	500	500	500	500	500	500
	通信費			420	480	600	600	600	600	600	600	600	600	600	600	600	600	600	600
	建物保険料			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
部	事務用品費			420	480	600	600	600	600	600	600	600	600	600	600	600	600	600	600
	会費会議費																		
	修繕費			350	400	500	500	500	500	500	500	500	500	500	500	500	500	500	500
	燃料費			350	400	500	500	500	500	500	500	500	500	500	500	500	500	500	500
	雑　　費			70	80	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	マチャコス政府委託費合計			***23,996***	***28,127***	***33,726***	***33,755***	***34,390***	***37,632***	***35,682***	***36,340***	***36,551***	***36,999***	***42,055***	***37,693***	***38,168***	***38,426***	***38,921***	***46,800***

マチャコス政府委託費＝年間収入−（仕入原価費+役員報酬+旅費交通費+広告宣伝費+会費会議費）

事業収支試算表 （単位：千円）

カテゴリ				初年度	1年目	2年目	3年目	4年目	5年目	6年目	7年目	8年目	9年目	10年目	11年目	12年目	13年目	14年目	15年目
収				70%	80%	100%	110%	120%	130%	140%	150%	150%	155%	160%	160%	165%	165%	170%	170%
入	年間収入			*159,656*	*182,464*	*228,080*	*250,888*	*273,696*	*296,504*	*319,312*	*342,120*	*342,120*	*353,524*	*364,928*	*364,928*	*376,332*	*376,332*	*387,736*	*387,736*
	電力費																		
	用水費																		
	リフト燃料、油脂費																		
	仕入原価費			124,428	142,204	177,755	195,530	213,305	231,081	248,856	266,632	266,632	275,519	284,407	284,407	293,295	293,295	302,183	302,183
	薬品費																		
	燃料費																		
	保全・修繕費																		
	労務費																		
	地代家賃																		
支	残渣処理費																		
	人件費																		
	役員報酬			8,000	8,000	10,000	11,000	12,000	13,000	14,000	15,000	15,000	15,500	16,000	16,000	16,500	16,500	17,000	17,000
出	福利厚生費																		
	旅費交通費			1,680	1,920	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
	交際接待費																		
	広告宣伝費			420	480	600	600	600	600	600	600	600	600	600	600	600	600	600	600
の	印刷費																		
	水道光熱費																		
	通信費																		
	建物保険料																		
部	事務用品費																		
	会費会議費			420	480	600	600	600	600	600	600	600	600	600	600	600	600	600	600
	修繕費																		
	燃料費																		
	雑　　費																		
支出計				134,948	153,084	191,355	**210,130**	**228,905**	**247,681**	**266,456**	**285,232**	**285,232**	**294,619**	**304,007**	**304,007**	**313,395**	**313,395**	**322,783**	**322,783**
エバーグリーン収支合計				*24,708*	*29,380*	*36,725*	*40,758*	*44,790*	*48,823*	*52,855*	*56,888*	*56,888*	*58,904*	*60,920*	*60,920*	*62,937*	*62,937*	*64,953*	*64,953*

エバーグリーン事業収支

売上 ＝ 年間収入

製造原価 ＝仕入原価費

諸経費 ＝役員報酬 + 旅費交通費 + 広告宣伝費 + 会費会議費

営業利益

3-1-1-A「Inception Report」

Project Formulation Survey on the Battery Recycling with Environmental Management System in Kenya

Inception Report

The joint survey team
consisted of:
Evergreen Co., Ltd. (Japan); and
IMG Inc. (Japan)

November 2013

1. Outline of the study

1-1. The current situation and remarkable challenges in waste battery disposal in Kenya

Kenya, the country with a population of 40 million and a 4.4 % annual GDP growth, is attracting a significant number of Japanese companies as the country plays the role as a gateway to the African market. Kenya is, however, still facing various challenges in environmental issues, including waste management. The government of Kenya is very conscious of this problem, and in fact, the issue was addressed in the national development programme, Vision 2030. Moreover, the government placed the establishment of a waste management system as one of the top priorities in its First Medium Term Plan 2008-2012.

The population growth and the lifestyle change of the citizens are the main causes of the increasing volume of waste in urban Kenya, especially in Nairobi. To tackle this problematic situation, Japan International Cooperation Agency (JICA) has been executing "The Project for Capacity Development of Solid Waste Management of Nairobi City" since 2012.

Among the challenges stated above, the disposal of waste batteries is considered to be one of the most remarkable issues. Along with the fast-growing number of private vehicles and mobile phone base stations, the amount of waste battery is expected to rapidly increase furthermore in the near future. Since the 90% of vehicle sales in Kenya consist of used cars, the collecting and recycling system for batteries is hardly operated by automobile manufacturers. As a result, inappropriate waste management system is largely operated by local companies, where the concerns on the damage to the environment and workers' health are escalating.

(photo) Many Kenyan youth manually extract lead plates from waste batteries [1]

For instance, in the current situation, the scrap lead plates are manually extracted from waste batteries as shown in the photo. Despite their protective clothing and equipment, these workers are at the risk of chemical burn or the loss of eyesight since their skin and eyes are exposed to toxic dilute sulfuric acid which leaks from the batteries. The health of neighboring residents is also damaged because dilute sulfuric acid is littered directly to the soil and ground water. In addition, many people develop serious health problems due to the air pollution that is contaminated by lead particles. Eco-Ethics International Kenya, a local environmental NGO, is warning that the blood lead level of recycling factory employees and that of neighboring residents tends to exceed the standard that is determined by World Health Organization.

[1] http://www.theguardian.com/global-development/2012/oct/24/pollution-health-problem-malaria-tb

Moreover, the outcome of our preliminary survey identified some threats in the disposal of waste battery in rural areas. Batteries are widely used for household utility in non-electrified areas, however, after the utilization, it is considered that most of these waste batteries are either abandoned without any appropriate processing or disassembled manually, leaving dilute sulfuric acid and lead behind.

Regarding the waste management, National Environmental Management Authority (NEMA) is currently drafting regulations for electronic waste. Nevertheless, it is uncertain whether the regulations would concern the management of waste batteries. In order to prevent further damages to the environment and health, the recycling system that we propose in this project needs to be established urgently.

1-2. Goal of the study

Given the current situation and challenges stated above, this study aims to investigate the feasibility of a new business model in which a Japanese recycling company, Evergreen Co. Ltd., set up a waste battery disassembly plant. Our target is, mainly through the disassembly plant we are going to establish in Kenya, to inaugurate and implement an Official Development Assistance (ODA) project that can be widely considered as a good example in waste management in the country. We also aspire to introduce the technical expertise in the relevant field to the country, precisely by applying the following resources that were already used in previous business experiences in Japan; the plan of the plant, the guideline on disassembly process and the archive on the environmental management system (EMS).

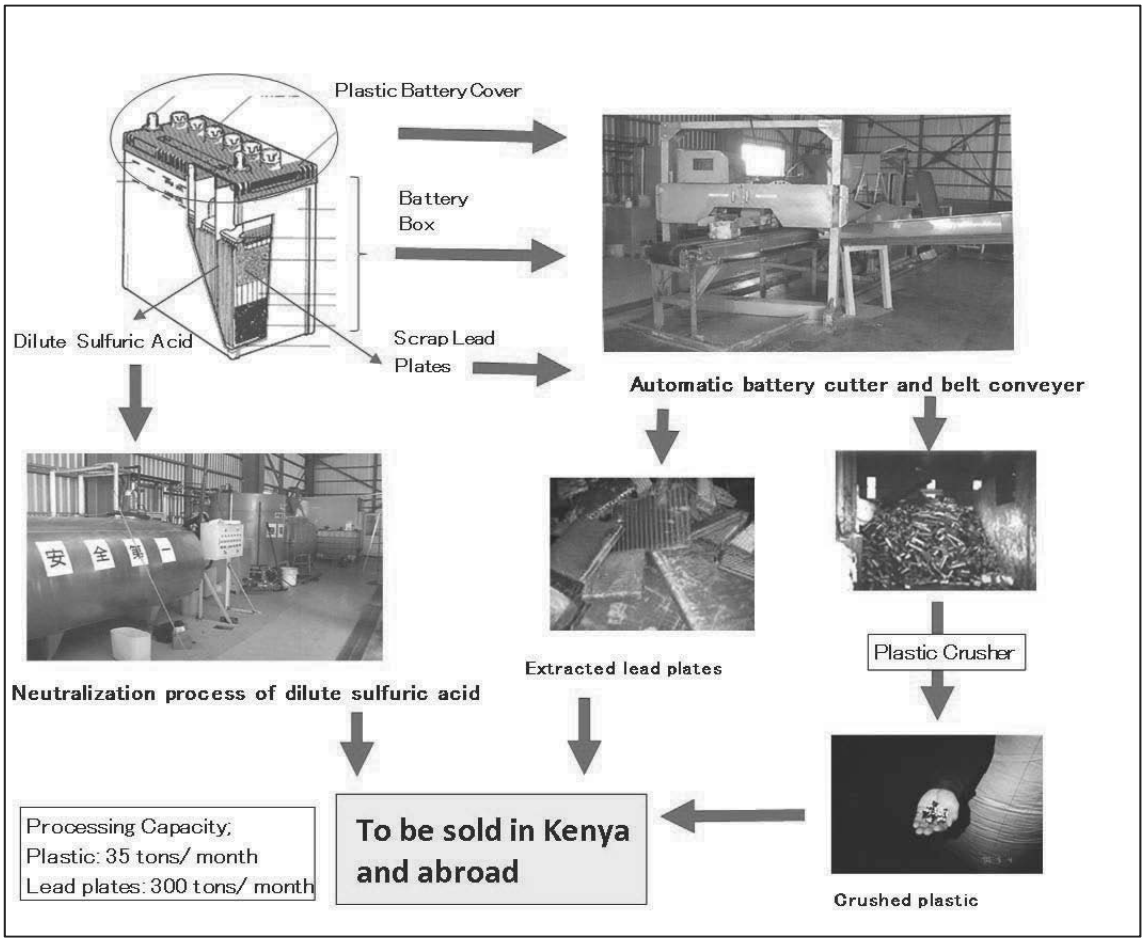
This study is predicted to be followed by an ODA project in public-private partnership (PPP), entitled as “Pilot Project for Disseminating Small and Medium Enterprises (SMEs)’ Technologies.” This ODA project will financially enable us to conduct the pilot business implementation, and will last for from one to two years. After the termination of the ODA project, the plant and facilities need to be transferred to the government while the business itself needs to be operated as a profitable and financially independent project. Therefore, this study will inspect various points to develop an outstanding business model, by reviewing the competition mapping in the recycling industry of Kenya, analyzing the competitiveness of our experience and expertise, investigating the necessity of localization of the system and examining successful business implementation models operated by both the government and Evergreen.

1-3. The proposed system that is subject to this study

(1) The proposed system

Under the proposed system, entitled as “Disassembly of Waste Lead Batteries in Kenya”, Evergreen plans to establish a recycling site near Nairobi. The system will strictly pursue the EMS of Japanese standards. With its predominant experiences in the operation of battery recycling plant in Japan, Evergreen is capable of developing a recycling system with high standard which adheres to protect the environment and the occupational health.

Chart 2: Outline of the recycling plant



(2) Three advantages of our plant

The following are the three main advantages of our disassembly plant;

The first advantage is the application of EMS that fulfills the high environmental standards of Japan. Evergreen has recycled a large amount of batteries there while strictly obeying the Japanese regulations for lead poisoning prevention, in addition to other environmental laws; therefore, it is expected that the company will demonstrate a good model of EMS in Kenya. This impact is also assumed to contribute to the raise of local environmental standards of waste management system in Kenya.

The second advantage is the automation of the disassembly process. Waste car batteries can be dismantled automatically by the usage of belt-conveyor and cutter, which allows the employees to be rarely exposed to hazardous materials. And hence, their health risk can be dramatically reduced.

The third advantage is the neutralization process of dilute sulfuric acid that complies the Japanese environmental standards, which in consequence, will minimize the environmental damages that have been caused by the inappropriate discharge of the toxic acid. This process is completed by adding caustic soda. After that, the neutralized substance is gathered and stored properly, while the remaining liquid waste is disposed.

(3) The experiences of Evergreen

Evergreen procured the necessary machineries for recycling and started the operation of its own battery disassembly plant in Hokkaido, Japan, where scrap lead plates were extracted from waste batteries. Evergreen first purchased waste batteries from all over Hokkaido at the rate of 40,000 JPY (34,500 KSH) per ton, and exported the scrap lead plates to refineries in South Korea at the rate of 65,000 – 85,000 JPY (56,000 – 73,000 KSH) per ton. In the mid 2000's, the company exported 260 tons of scrap lead plate per month, which made its annual sales 200 million JPY (170 million KSH). Evergreen was highly appreciated by the Korean refineries for offering reasonable and competitive prices. Based on this successful experience, Evergreen now aims to transfer their technology and launch the business model in new markets.

1-4. Tentative ODA project plan (pilot implementation of business)

We plan to conduct the pilot implementation of our business model through JICA's "Pilot Project for Disseminating SME's Technologies" after the completion of this feasibility study. It is important to note that the ODA projects require to be operated under the partnership with the Government of Kenya. The following are the elements of the pilot project;

a. Establishment of battery recycling system and verification of the feasibility of business model; collection of used batteries, technology transfer, pilot operation of the disassembly plant, development of sales channel of lead plate, test marketing
b. Installation of EMS in the plant

(1) Establishment of battery recycling system and verification of the practicability of business model

Based on the expertise Evergreen has obtained from its previous business experiences in Hokkaido and Tohoku Region of Japan, the company will establish a battery disassembly plant in Kenya so as to collect and dismantle waste batteries and examine the profitability of the business model. According to the current plan, the dimension of the plant is going to be approximately 3,300 m^2 (equivalent to 5 tennis courts), and ideally, the processing capacity of machineries to be installed will be 170 tons per day.

Collection of batteries will be outsourced to already existing local collectors and their network. The purchasing rates must give incentive to these collectors, and thus, will be determined so that the battery collecting system will efficiently expand. Besides, the practicability of localization of the disassembly system will be examined through the pilot operation by local employees; regarding this, the skill level of local human resources and the availability of relevant infrastructure will be the main indicators to measure the practicability of localized operation. Moreover, the profitability of the business model will be determined by the development of sales channels; in this regard, we plan to sell the lead plates to refineries and battery manufacturers in both Kenya and other emerging markets, such as India, where the demand of lead is expected to show a remarkable increase.

During the pilot project phase (the ODA project phase), it is required that the Government of Kenya or Kenyan public agencies play the role as co-implementer.

(2) Application of the Japanese-standard EMS to the recycling plant

In order to maximize the developmental impact of the project, the Japanese standard EMS will be installed in our battery recycling plant in Kenya. By applying this EMS, our plant will be able to demonstrate a successful model of waste battery management in Kenya under the partnership with the government. This eventually is expected to facilitate the expansion of high environmental management standards in the relevant industries.

Indeed, some companies have already started battery recycling businesses, and legal frameworks to protect the environment and the occupational health are also starting to be established. Yet, on the other hand, some companies, informal sectors and a number of collectors in the industry still remain very harmful, mainly due to the absence of environmental guidelines under the legal frameworks.

Our business model will apply its own standards to protect environment and occupational health, in addition to an internal auditory system. We aim that these standards and system prove to be very efficient and useful during the ODA project phase, which in the long run, will begin to function as the Kenyan standards of waste battery management. In order to accomplish this, we intend to promote the case to the governmental agencies.

1-5. Expected developmental impacts of the proposed ODA project

The Government of Kenya acknowledges the necessity to build waste management systems, and it is mentioned even in its mid-term and long-term developmental plans. By demonstrating a successful model of waste battery management operated locally, this project will contribute to an upswing of the standard of battery recycling system in the country. Likewise, this project will result in raising the environmental awareness of the actors in the Kenyan waste management industry, as the environmental standard applied in our plant will eventually motivate the others in the entire industry to improve their own standards. As a consequence, this effect will contribute to the sustainable development in Kenya.

1-6. Business expansion plans

Evergreen has a goal to increase its annual sales from businesses in emerging markets up to 500 million JPY (433 million KSH) by 2020. Towards this goal, the company aims to expand its business in the markets outside Japan, and by 2015, the sales in such markets is targeted to reach the same level as that in Japan, notably by building comprehensive waste management systems, including industrial waste recycling, vehicle waste recycling and the selling of recycled valuable materials. The battery recycling business in Kenya will be the foundation of the business expansion plan mentioned above: the company aims to achieve its goal by diversifying the materials to be collected and recycled, and also, by expanding the sales channels in South Asia and the Middle East.

(1) Time frame

During the feasibility study, we plan to gather useful information for the drafting of the ODA project plan that is expected to be implemented under the scheme of “Pilot Project for Disseminating SME’s Technologies.” Our intention is to gain financial support from JICA in 2014, and conduct the ODA project until September 2016 at most.

The detailed time frame of the ODA project is as follows: after the completion of this survey, the construction of the recycling plant will begin in September 2014, and the operation of the

pilot business will take place from April 2015. After the termination of the ODA project, it is expected that the operation of the plant will continue to be executed both by the government and Evergreen.

For this reason, we aim to begin a series of discussions and negotiations with the relevant governmental agencies even during the feasibility study phase.

(2) Business model

Based on the previous business experiences in Japan, we are convinced that following two factors will lead our business to success.

Firstly, Kenya is blessed with potentials to collect waste batteries. The quantity of waste car batteries that can be collected is estimated to be sufficiently large, and given the growing number of vehicles, it is expected to keep increasing furthermore. The same thing can be said for industrial batteries. Automobile manufacturers, which usually take responsibility to collect waste batteries of new vehicles, hardly collect batteries in Kenya due to the domination of second-hand cars in the market, and for this reason, the chance for us to collect such batteries is relatively high. Additionally, Kenya's geographic location allows to gather batteries from neighboring countries.

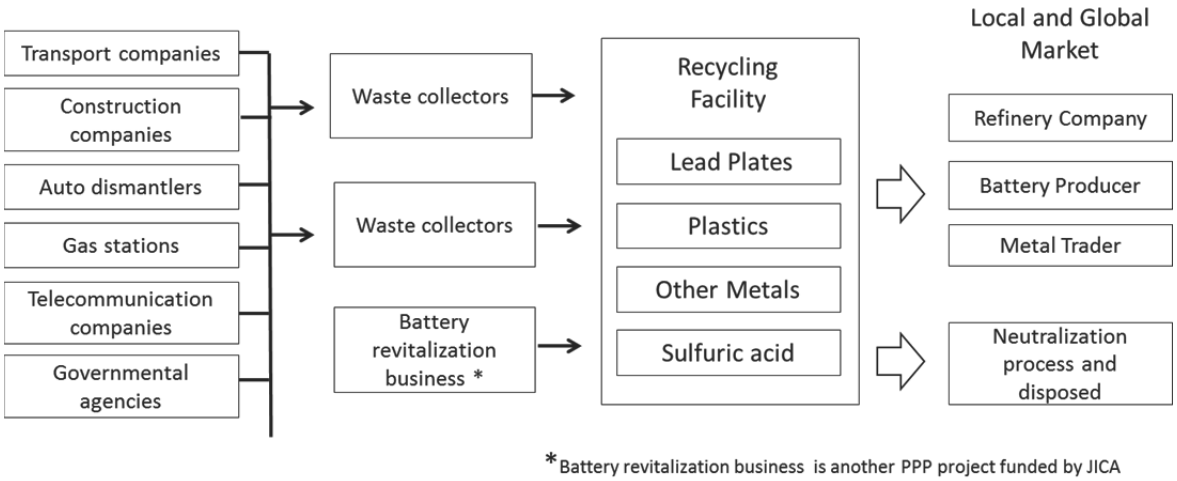
Secondly, it is practical to export recycled lead plates from Kenya to refineries in South Asia, the Middle East and North Africa as the country faces the Indian Ocean. In the emerging economies in these regions, the supply of lead and plastic is not satisfying the high demand, so it is considered that the profitability will be very high if the export of recycled materials is realized with stable quantity. Mr. Kimura, the CEO of Evergreen, has considerable experience in the international business of recycled materials.

The suppliers of waste batteries are the keys for success in this project. Such suppliers include transport companies, construction companies, auto dismantlers, gas stations, telecommunication companies and governmental agencies. The break-even point of this business is to collect 157 tons of waste batteries per month. In order to secure this procurement amount, battery collection will be subcontracted to already-existing waste collectors and transportation companies, and we will set competitive rates to give such actors incentives to supply to our recycling plant.

Through the preliminary research, approximately 100 local waste collectors were identified. This number is estimated to become larger if unregistered informal collectors are included.

Collected batteries will be disassembled into lead plate, plastic, dilute sulfuric acid and other metals in intermediate process. Dilute sulfuric acid, which is a toxic substance, will be neutralized by caustic soda so that it will become harmless to the environment. Also, we intend to establish a strict management system for the protection of the health of employees who actually are engaged in the dismantling process. In the end of this process, extracted scrap lead plates and plastic will be distributed to refining companies and battery manufacturers in Kenya and overseas.

Chart3: Planned Business Model



1-7. Investment and sales plan

The initial cost, which will be allocated for the construction of plant and the installation of machinery, is estimated to be approximately 50 million JPY (43 million KSH) and expected to be covered in the ODA scheme, “Pilot Project for Disseminating SME’s Technologies.” This cost estimation was calculated based on the facility built in Hokkaido, which cost 70 million JPY (60 million KSH). The operation in Kenya will break even by collecting 7 tons of batteries per day (157 tons per month).

The business will have a temporal goal to gain the annual sales of 100 million JPY (86 million KSH). The annual expenditure is estimated to be 34.63 million JPY (30 million KSH), among which the maintenance and operation cost of the plant is 18.75 million JPY (16.24 million KSH) and administrative and general cost is 15.88 million JPY (13.76 million KSH)[2].

[2] This income and expenditure plan belongs to the business managing board in the government since the governmental agencies are to become the leading stakeholder of the ODA project. Given this structure, Evergreen expects to establish a scheme under which the company gains income from the operational fees paid by the governmental agency.

2. The content and methodology of the study

2-1. General policies of the study

We plan to organize a field study, in addition to the bibliographic survey and other researches that have been already conducted. During the study period, we plan to contact the potential counter parts, ideally the governmental agencies which serve in the field of waste management, and discuss on the business model while seeking for their interest in collaborating with us. The study aims to collect information on the local demand for battery recycling plant, as well as to find out about the key factors that are critical for the success of the business. Such key factors include not only the identification of project site, battery collectors, and customers, but also, the establishment of financial balance model, operational model and outsourcing model. Furthermore, we will facilitate the potential counterparts to understand the advantages of proposed project, precisely by comparing quality of our technologies and system with other competitors both in Kenya and abroad.

Meanwhile, we will analyze the current situation of waste battery management system in Kenya and review the environment and conditions in the prospective project site: the outcomes of these investigations will allow us to modify the recycling systems in a more appropriate way to the local context. Other important factors which need to be well considered before the launch of pilot project also must be addressed.

Concerning the content of this study, it consists of the following four components:

A) identification of battery collecting channels
B) identification of prospective project sites
C) development of domestic and global sales channels of extracted scrap lead plates
D) establishment of partnerships with governmental agencies in Kenya

The field missions will be conducted twice during the entire study period, and the study team will visit not only Kenya but also other countries where our potential customers can be identified. During the first mission, the team plans to visit India, which will be followed by the trip to the United Arab Emirates during the second mission. Yet, one of the study team members will stay in Kenya for two months to collect relevant information constantly to efficiently carry out the study.

With reference to the component D, we tentatively plan to focus especially on the National Environmental Management Authority (NEMA), the auditory board in the field of environmental management, and one of the counties located near Nairobi, a prospective co-operator of our business model. These agencies are considered to be the most prospective counterparts of the project, and thus, through the period of field study, we are going to identify the relevant departments and officers that have the possibility of being in charge of our project.

2-2. TOR of the study

The study will be conducted as shown in the table 1. The 4 fundamental components are categorized into (A) to (D) as follows.

A) identification of battery collection channels
B) identification of prospective project sites
C) development of domestic and global sales channels of extracted scrap lead plates

D) establishment of partnerships with governmental agencies in Kenya

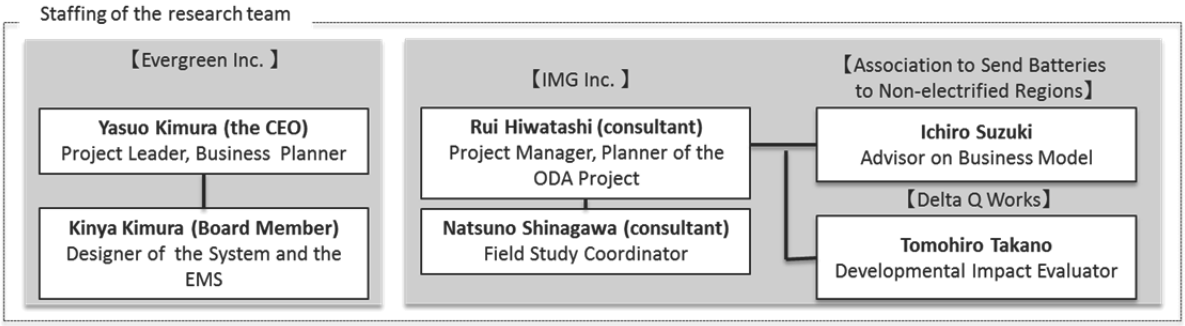
Table 1; TOR of the study

Basic Research	・ Conducting general research on the distribution, disposal, and market prices of waste car and industrial batteries. Conducting general research on main players. (A, B, C, D) ・ Listing potential partners to compose the battery collecting system, making appointments (A) ・ Determining the terms and conditions for the construction of recycling plant (B) ・ Identifying prospective project sites and making appointments for site visits (B) ・ Shortlisting potential customers to supply with the recycled lead plates, making appointments (C) ・ Conducting research on the legal framework and policies regarding the environmental issues and the protection of occupational health (D) ・ Identifying the governmental agencies that are related to the issues above, making appointments with them (D)
First Field Mission	・ Conducting interviews with prospective battery suppliers. Gathering information about the quantity they currently deal with and seeking for the degree of interest in collaborating with our business (A) ・ Visiting prospective project sites and checking how suitable these sites are to the required terms and conditions for the construction of plant (B) ・ Assessing the demand for recycled lead at refineries in Mumbai (C) ・ Conducting interviews with relevant governmental agencies to examine the current trend of waste battery disposal and the possibility of future partnerships in project implementation. (D)
Business Model Development	・ Selecting tentative battery suppliers, project sites and customers (A, B and C) ・ Drafting the business plan and the ODA project plan (A, B, C, D)
Second Field Mission	・ Presenting business model to prospective battery suppliers and gaining agreement for future partnership (A) ・ Re-visiting the prospective project sites and making the final decision (B) ・ Assessing the demand for recycled lead at refineries in the UAE (C) ・ Presenting business model to relevant governmental agencies and gaining agreement for future partnership (D)
Planning and Reporting	・ Developing the business plan ・ Developing the ODA project plan. ・ Developing the construction plan of the recycling plant ・ Composing the final report of the study

2-3. Presentation on the recycling system

During the study, we will present some technical information to the prospective counterparts and business partners. The contents of such information include the manual of disassembly process, the archive on the EMS which is to be applied in our plant, and the architectural plan of the Japanese recycling plant that has been operated by Evergreen. Through the presentation and the following discussion, we intend to examine the practicability of the business implementation in Kenya.

3. Staffing of the study



Proposal

Battery Recycling with Environmental Management System

For Machakos County Government

4 December 2013

The joint feasibility study Team
Evergreen Co., Ltd. (Japan); and
IMG Inc. (Japan)

Background / Introduction

Evergreen Co. Ltd. is a Japanese company specializing in recycling business. Under the partnership with the Government of Japan, the company plans to start a new recycling business and establish a disassembling and smelting plant for waste batteries in Kenya; hence, the feasibility study for this business is currently being conducted.

As Machakos County Government is considered to be an ideal partner for business operation, the company aims to discuss in details on the ways to collaborate with the Government.

This proposal describes advantages and requests for Machakos County when conducting the project, in addition to the business model overview and project timeline.

Advantages for Machakos County

1. Investment-in-kind; A plant including machineries (approx. 42.5 - 60 million KSH), financed under Japanese ODA.
2. Creation of Employment; 20 direct employments and 100 indirect employments
3. Technical Assistance from Japan in the establishment of environmental guidelines to grow the Government's capacity in environmental management
4. Corporate income tax from the estimated average annual gross profit of 17 million shillings* and contribute largely to the local economy

* Average gross profit after the 5th year of business operation

Request for Cooperation

- To provide an appropriate plot of land for the plant in the location that is practically and economically accessible for battery suppliers who regularly come from Nairobi
- To jointly implement the pilot project with Evergreen
- To coordinate with National Treasury with regard to custom duties / tax exemption
- To ensure proper and effective O&M of the plant, which will be handed over from Japan International Corporation Agency (JICA) after completion of the pilot project, by appointing Evergreen as service provider

Prospective Plan of the Battery Disassembling Plant

Evergreen's battery disassembling plant and battery recycling business are to:

- Be harmless to the environment
- Comply with the occupational health and safety
- Be socially responsible with traceability
- Improve the quality of waste battery management in Kenya and raise the relevant standards

Problems in waste battery management

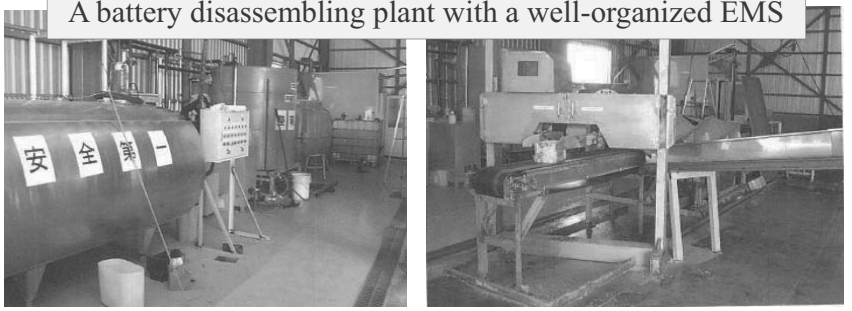
- Serious damages to the local environment
- Poor compliance with occupational health and safety
- Intractability for inadequate disassembling

Manual disassembly of batteries

Our solution

- Establish disassembling plant and battery recycling business with Environmental Management System
- Support tightening regulations and drafting operational guidelines with the cooperation of The Government of Kenya

A battery disassembling plant with a well-organized EMS



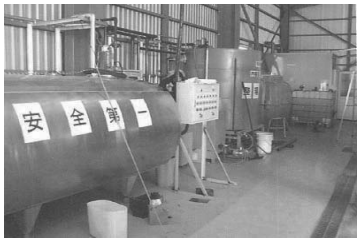
* Average gross profit after the 5th year of business operation

Prospective Plan of the Battery Disassembling Plant

(1) Automatic cutter and belt conveyor

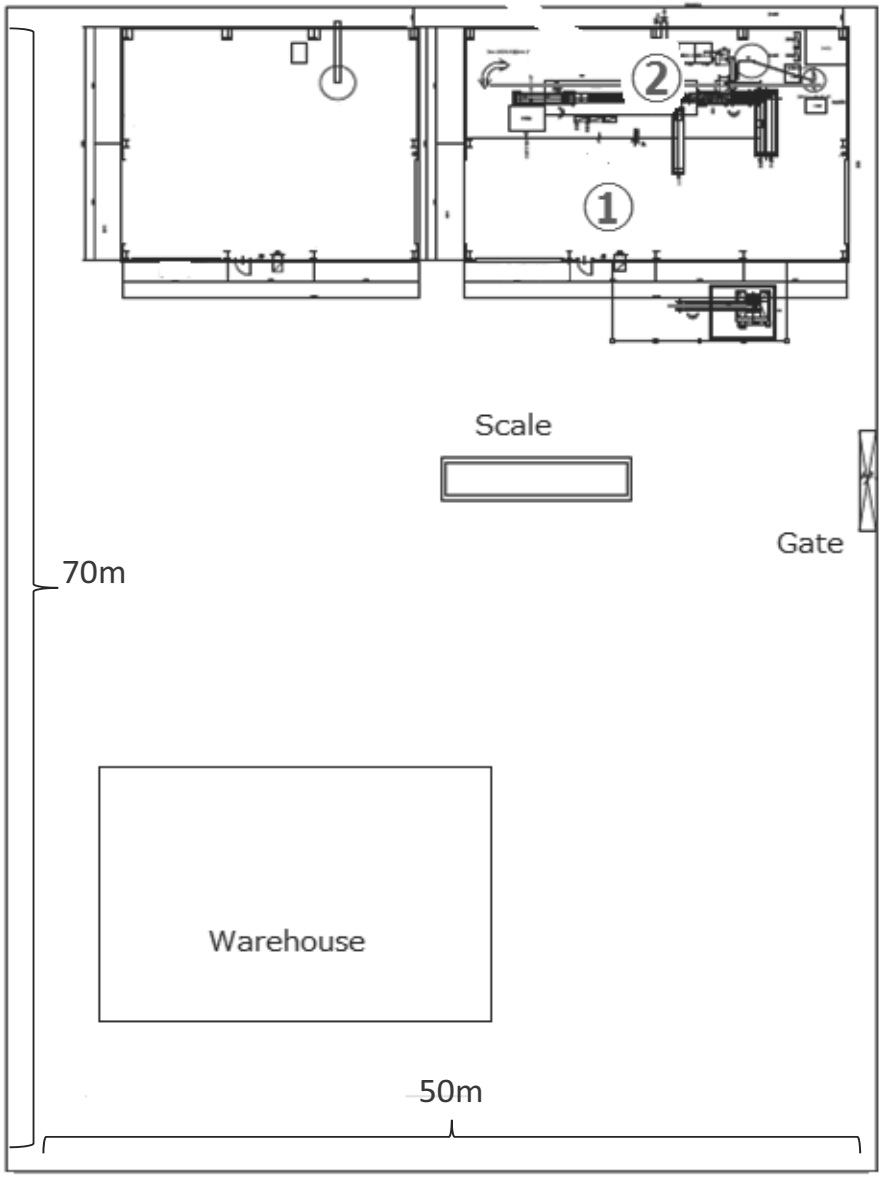
The machines automatically cut and remove the lid of battery case. This process minimizes the human exposure to sulfuric acid.

(2) Counteraction of Dilute Sulfuric Acid



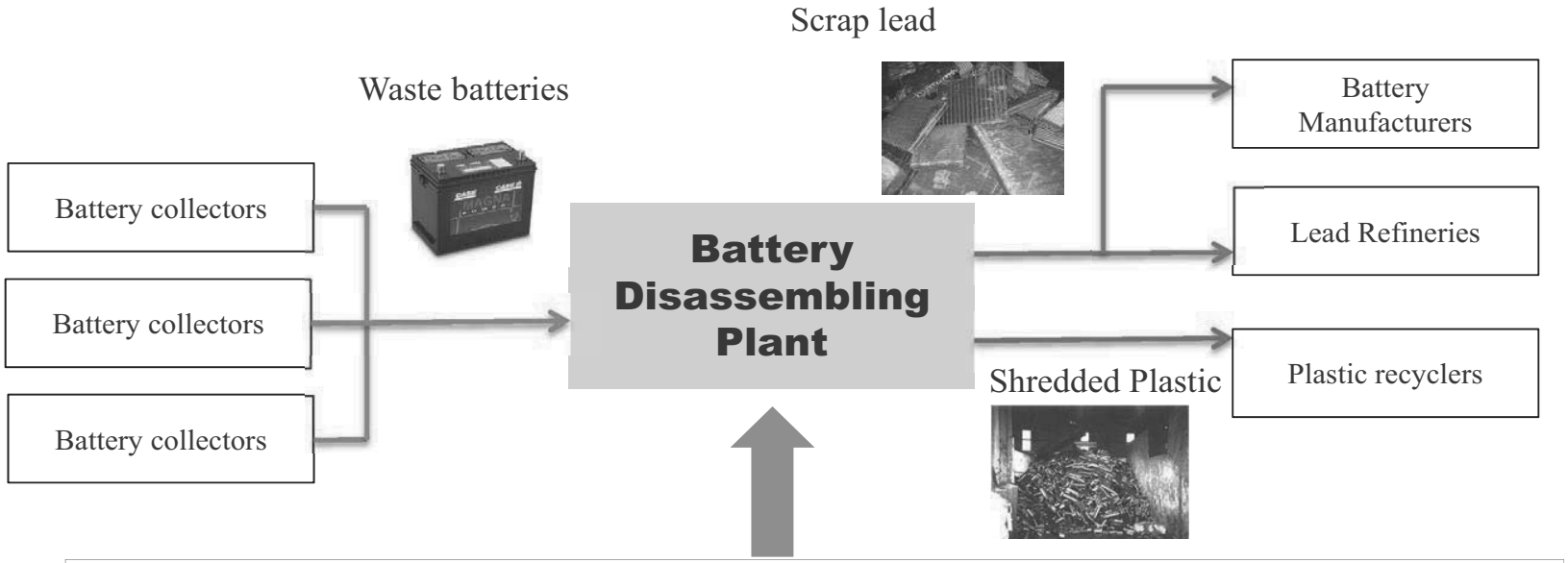
In this process, dilute sulfuric acid is counteracted by adding caustic soda, and transformed into water that can be discharged.

Prospective location : Machakos County
Major machineries: Automatic belt conveyors, Counteraction of dilute sulfuric acid, Melting furnace
Total Area: 3500㎡ (70m x 50m)
Estimated amount of waste batteries to be disassembled : 8 tons / day, 175 tons / month
Cost of assets: US$700,000 (approx. 60 million shillings)



The Overview of Business Model

- Our business model is estimated to involve;
  - Collection of used car batteries
  - Disassembling of batteries into scrap lead and plastic
  - Smelting of scrap lead
  - Distribution of scrap lead, smelted lead and plastic to local and global markets
- The result of feasibility study implies that our business model will be profitable

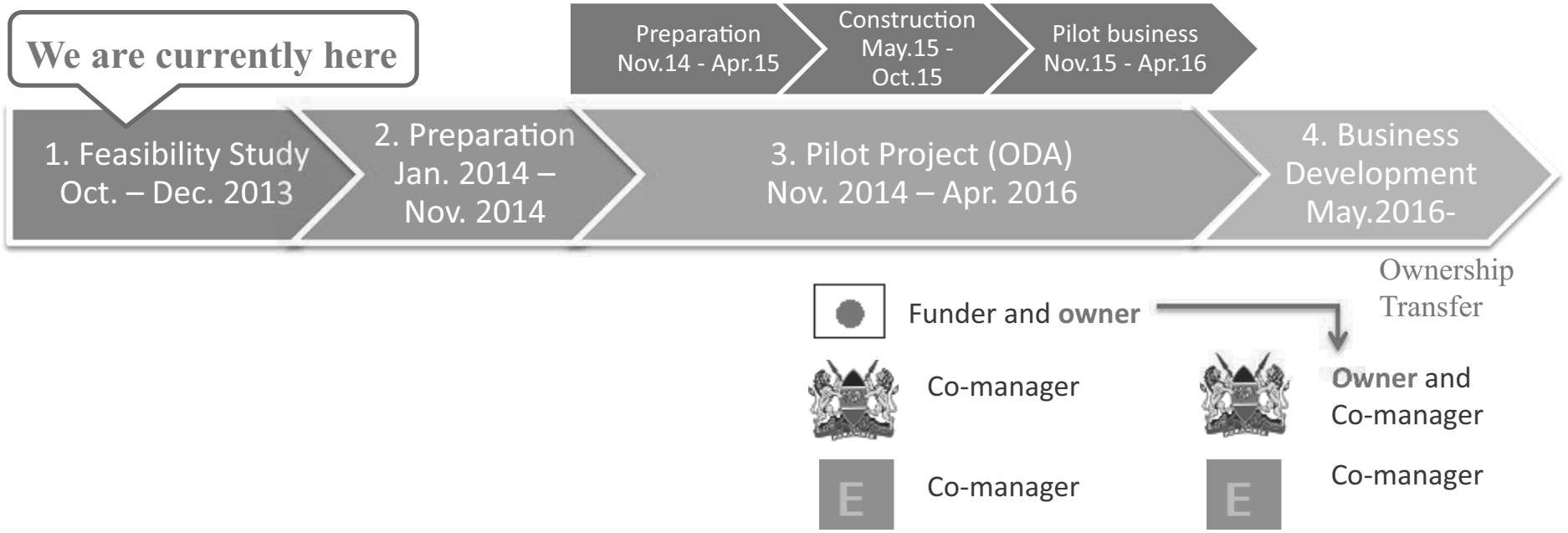


Application of Environmental Management System

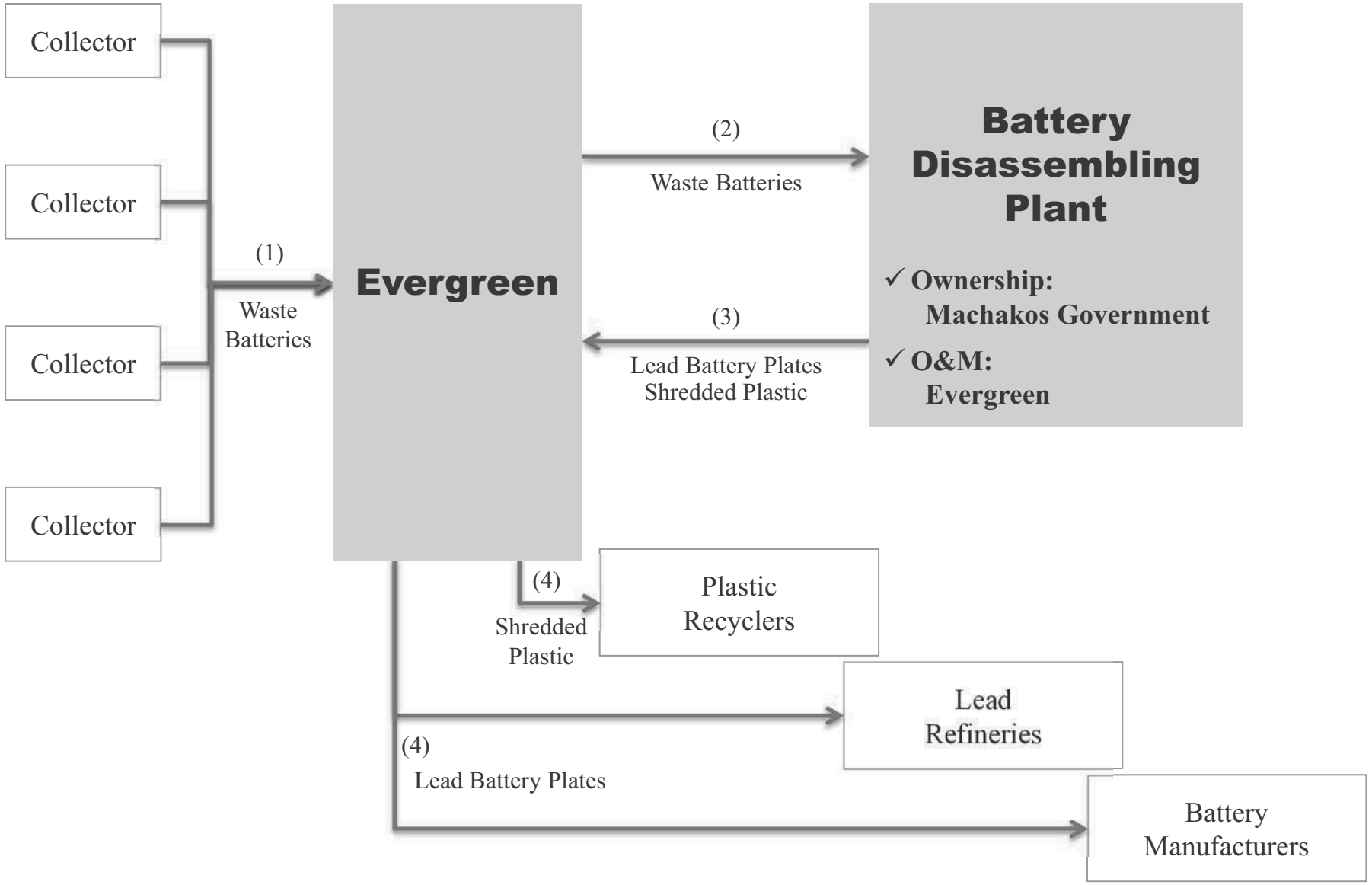
- Development of check-list of matters to be strictly obeyed in the plant
- Maintenance of the cleanness of the plant
- Detailed rules for the workers to prevent accidents
- Internal environmental audits to meet the Japanese environmental standards

Project Timeline

- During the preparation phase, Evergreen is planning to start the battery collection
- The first 6 months of the pilot projcet phase will be spent to prepare for the pilot business, such as Environmental Impact Assessment and other relevant legal procedures
- During the pilot project phase, the plant, including the machineries, will be funded under ODA of the Government of Japan
- After the pilot phase, the assets will belong to Machakos County, i.e. **ownership transfer** from Japan to Kenyan authority will occur at the end of pilot project phase
- During the pilot project and business development phase, Machakos County and Evergreen are expected to co-manage the plant and business model



Detail Business Flow (at a post-ODA business stage)



Relevant stakeholders and their expected roles

Key Stakeholders	Expected Roles	Matters to be discussed on in the future
National Environment Management Authority	• To publish legal guidelines for waste battery management • To assist in compliance with environmental regulations • To become a signer of the ODA project	• The content of the legal guidelines for waste battery management • Request to become a signer of the ODA project
Machakos County Government	• To co-manage the business with Evergreen Co. Ltd. • To provide a plot for the plant and other practical assistance • To become the transferee of the assets (i.e. the plant building, machineries) • To become a signer of the ODA project	• Conditions, method, schedule and organizational structure of co-management • Conditions on profit sharing and purposes of the profit use • The prospective plot for the plant and the conditions for the land provision • Request to become a signer of the ODA project
Ministry of Devolution and Planning	• To become a signer of the ODA project	• Request to become a signer of the ODA project
Ministry of Environment, Water and Natural Resources	• To become a signer of the ODA project	• Request to become a signer of the ODA project

Other Stakeholders	Expected Roles	Matters to be discussed
Export Processing Zones (EPZ) Authority	• To provide the direction to obtain the EPZ license if necessary	• Detailed procedures to obtain the EPZ license

Profile of the joint feasibility study team

Evergreen Co. Ltd.

Main Activities :

- Waste Collection and Disposal
- Trade of Lead Batteries
- Trade of Metals and Plastics
- Trade of Used Electric Machines

Address : 133, Kamishinoro, Shinorocho-cho, Kita-ku, Sapporo-shi, Hokkaido, Japan

Contact :

TEL : +81-(0)11-773-5550

Mail : evergreen@sound.ocn.ne.jp

IMG Inc.

Main Activities :

- Development Consultancy
- Business Management Consultancy

Address : 3-32-6 Miyazawa, Seya-ku, Yokohama-shi, 246-0038 Japan

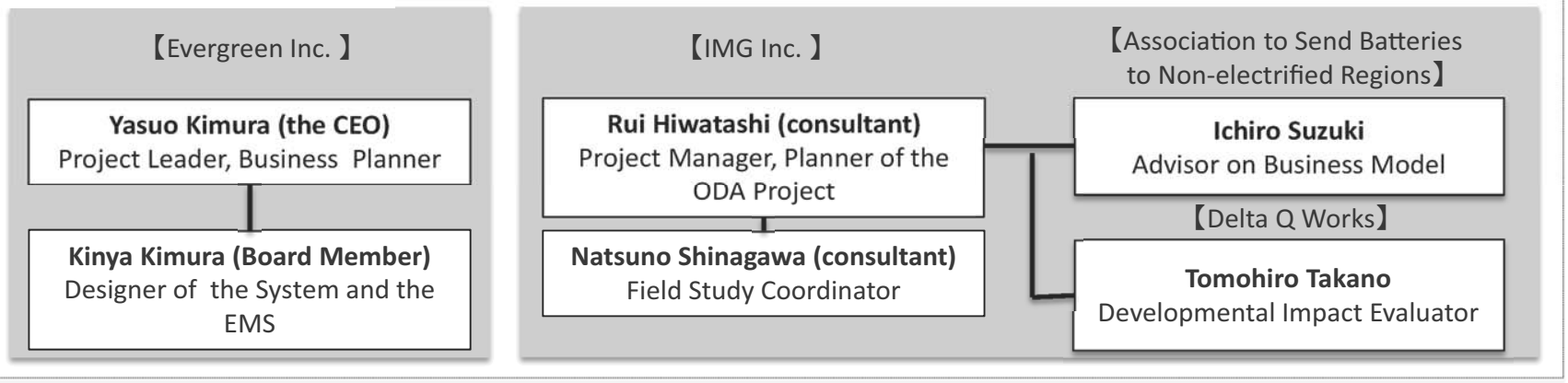
Contact :

TEL : +81-(0)90-9106-6107

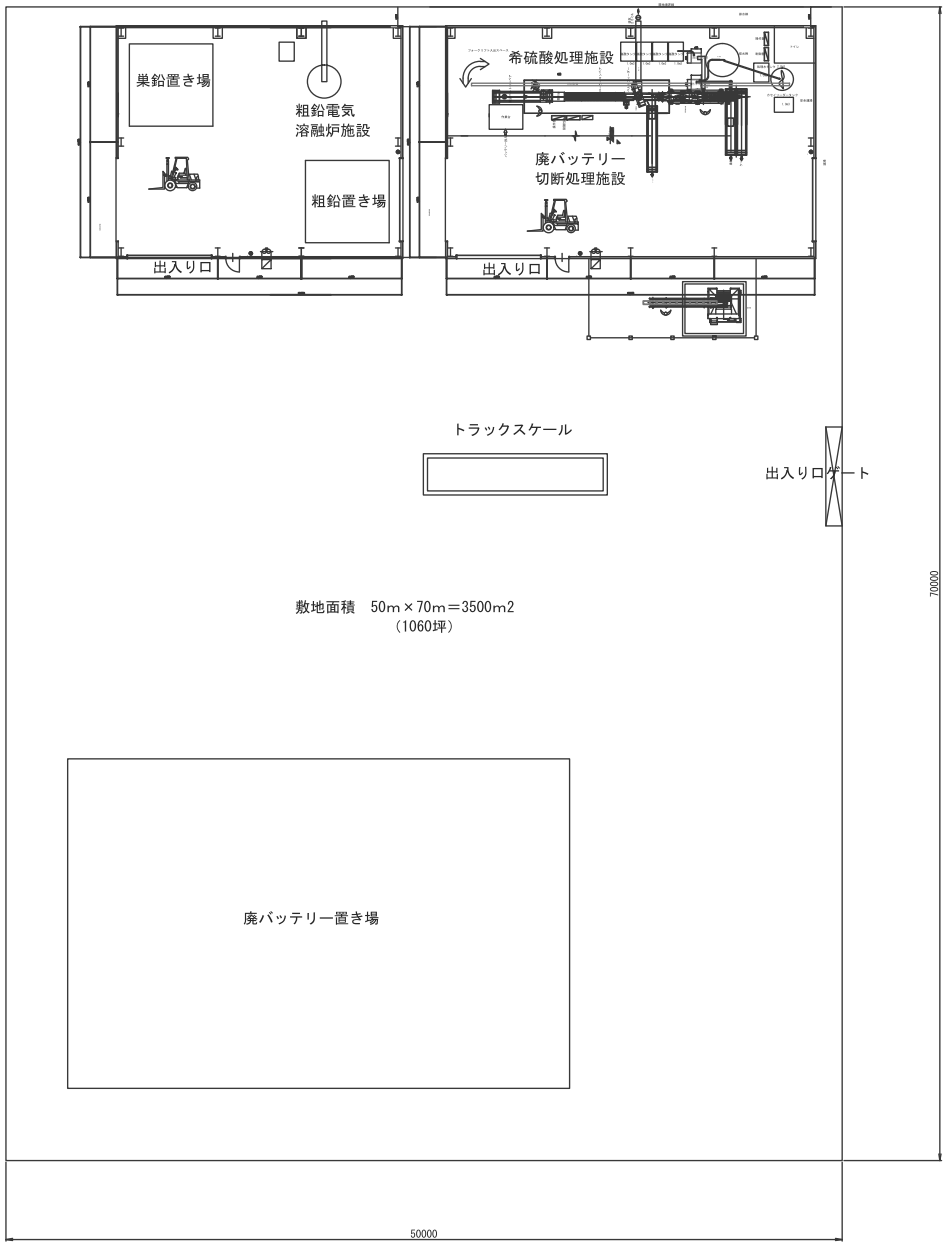
Mail : rui.hiwatashi@imgpartners.com

Web : http://imgpartners.com/

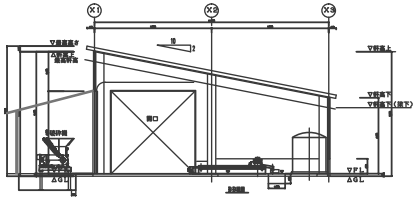
Staffing of the F/S team



平面図



建屋断面図



3-1-1-C「マチャコス向け施設図面」

㈱A＆E　廃バッテリー処理事業プロセス

廃バッテリー解体

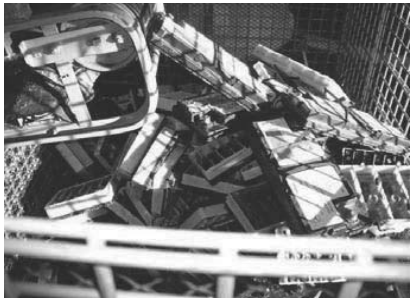
② 廃酸分離

廃酸は専用タンク積替保管後、処理工場へ排出

③ 巣鉛分離

① トップケース分離

トップケースは破砕機で破砕後売却



④ 本体ケース分離

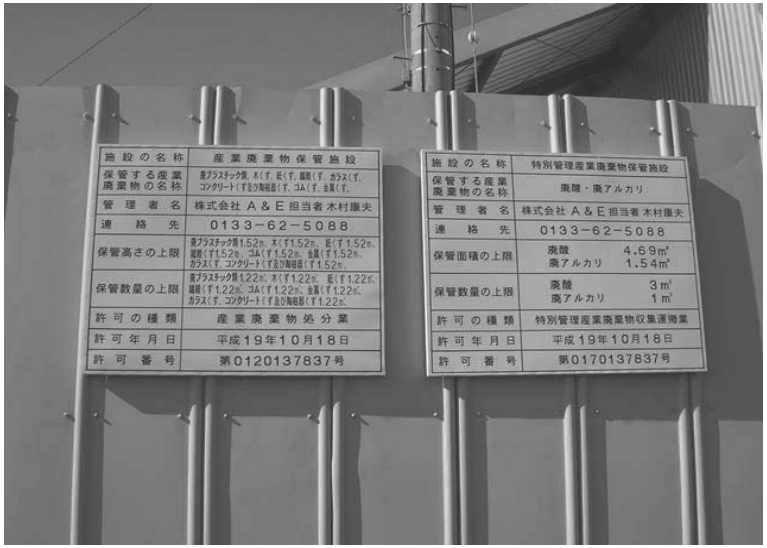
ケースは破砕機で破砕後売却

㈱和昌へ巣鉛出荷

3-1-1-D「北海道実績_処理プロセス写真」

石狩リサイクルセンター写真

許可証看板



施設の名称	産業廃棄物保管施設
保管する産業廃棄物の名称	廃プラスチック類、木くず、紙くず、繊維くず、ガラスくず、コンクリートくず及び陶磁器くず、ゴムくず、金属くず。
管理者名	株式会社 A＆E 担当者 木村康夫
連絡先	0133−62−5088
保管高さの上限	廃プラスチック類1.52m、木くず1.52m、紙くず 1.52m、繊維くず1.52m、ゴムくず 1.52m、金属くず1.52m、ガラスくず、コンクリートくず及び陶磁器くず1.52m、
保管数量の上限	廃プラスチック類1.22㎥、木くず1.22㎥、紙くず1.22㎥、繊維くず1.22㎥、ゴムくず1.22㎥、金属くず1.22㎥、ガラスくず、コンクリートくず及び陶磁器くず1.22㎥、
許可の種類	産業廃棄物処分業
許可年月日	平成19年10月18日
許可番号	第0120137837号

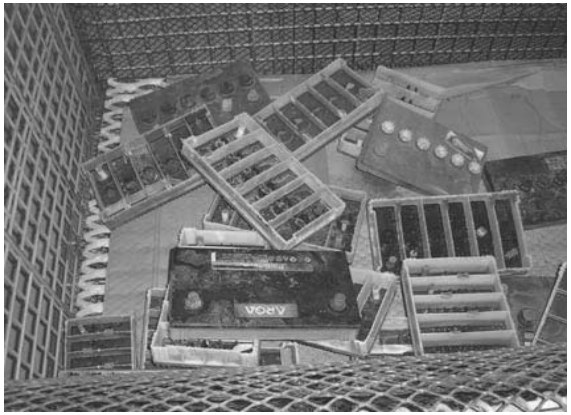
施設の名称	特別管理産業廃棄物保管施設
保管する産業廃棄物の名称	廃酸・廃アルカリ
管理者名	株式会社 A＆E 担当者 木村康夫
連絡先	0133−62−5088
保管面積の上限	廃酸 4.69㎡ 廃アルカリ 1.54㎡
保管数量の上限	廃酸 3㎥ 廃アルカリ 1㎥
許可の種類	特別管理産業廃棄物収集運搬業
許可年月日	平成19年10月18日
許可番号	第0170137837号

廃バッテリー解体後仕分け

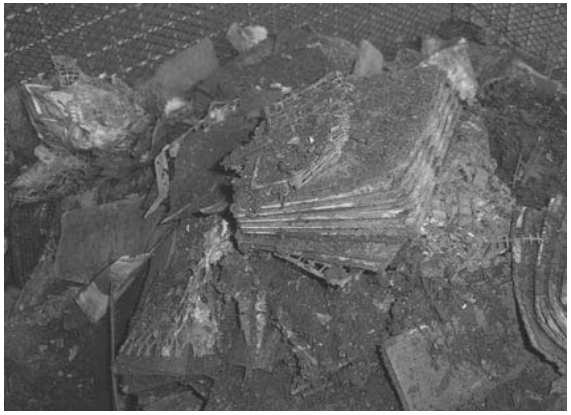
巣　鉛

ケース

トップケース

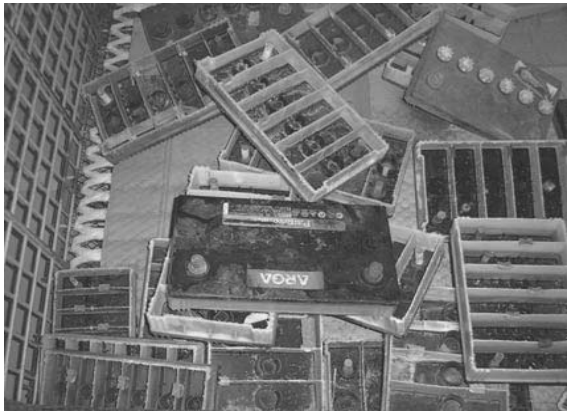


巣　鉛



ケース

トップケース



廃バッテリーサンプル写真

通信用・非常用設備・OA機器バックアップ用
（鉛）

通信用・非常用設備・OA機器バックアップ用
拡大写真

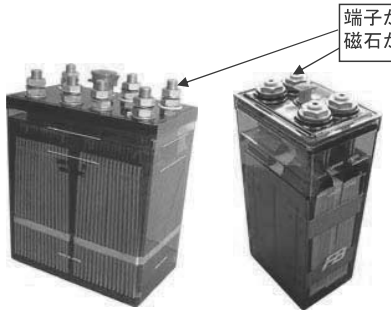
システム・業務関係用（鉛）

システム・業務関係用（鉛）

清掃機械用（鉛）

防災機器・事務用（ニッケル）

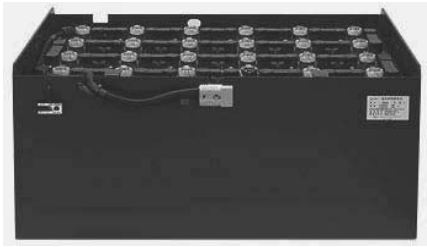
廃バッテリーサンプル写真



アルカリバッテリー

据置型バッテリー（鉛）

※注意　形が似ている。



バッテリーフォークリフト用（鉛）

オートバイ用（鉛）

※　基本的に鉛は全て当社で有価買取OK
　但し、これら産業用は国内では、自動車用と違い買取値段がかなり安価です。
　　アルカリについては、浄水場や下水処理場、鉄道などから出る
　　アルカリについては、処分費用を受け取ることになる。
　　ニッケル等は鉛でないので買取の対象外

株式会社　Ａ＆Ｅ　　廃バッテリー解体設備

－法規則－

１．労働安全衛生法、労働安全衛生施工令、労働安全衛生規則、鉛中毒予防規則が適用されます。
２．届け出書類は、労働安全衛生法様式第２０，２５，２６号です。
　但し、法第８８条－施工令第２４条で、（電気使用設備の定格容量が「３００キロワット」以上のものとする。）とある。
３．鉛作業主任者テキストには、わかりやすく書かれています。

＜抜粋＞
１．作業者は、鉛及び希硫酸との接触防止の為、防災面、マスク、ゴム手袋・長靴等の着が必要です。
２．控え室や食堂に入る場合、上記保護具、衣類等に付着した鉛を持ち込まないようにしなくてはなりません。作業場近くに、洗眼設備、手荒い設備が必要です。
３．鉛取り扱い従事者は、特殊健康診断が必要です。
　作業場所の作業環境測定が必要です。
　作業主任者の選任（鉛作業主任者技能講習を終了した者）

－鉛対応－

＜除塵設備について＞

１．液入りバッテリーの切断機は、前回配置図に記載致しました、排ガス処理装置（樹脂製）を使用し、ミストを吸引しています。

２．液無しバッテリーの切断機は、SS 製バッグフィルターで、処理をしています。（ミストが有ると使用不可）

＜保護具の装備＞

１．ヘルメット、防災面、防塵マスク、防護頭巾、不浸透製衣類、雨合羽、不浸透製手甲、ゴム手袋、ゴム長靴

＜作業場＞

１．入り口近くに目洗眼設備、手洗い設備、爪ブラシ、洗剤を設置しています。

２．休憩、食事、喫煙は、作業場所では、禁止です。

３．場内は、毎日作業終了時床の洗浄（高圧洗浄機）実施しています。

４．フォークリフトのタイヤ付着による付近への鉛汚染があります。

＜控え室＞

１．入り口に、衣類埃落としブラシ、靴底水洗マットを設置しています。

２．鉛作業を行った上着、保護具類の持ち込みの禁止。

３．毎日室内、マットの掃除実施しています。

＜ロッカー室＞

１．鉛作業着用ロッカー、控え室用ロッカーを設置しています。

２．洗濯機（鉛作業衣類専用）を設置しています。

＜その他＞

１．退勤時風呂の入浴（頭髪、顔、手を重点に）をさせています。

２．退勤用着替えロッカーを設置しています。

３．毎週ゴム手袋、防塵マスクの点検、フィルター交換を実施しています。

４．脱鉛のために、牛乳（２００ミリリットル）を支給しています。

－機械の管理－

＜切断機＞

１．予備鋸刃が必要　　０．５～１．５ｔ／本

２．鋸ローラー　　ＳＳ焼き入れ品　　６０～８０ｔ／６ヶ（１台分）

　　プラ、鉛屑が付着する。時々除去する。

３．鋸プーリー　　ゴムバンド　　１６０～２００ｔ／２本（１台分）

４．軸受け　　グリース　　１回／月

５．操業終了時水洗い、鋸刃取外、周辺掃除（ プラ、鉛屑飛散）

＜フィーダー＞

１．ベルト　　ＴＣ実績　２～３年

２．軸受け　　グリース　　１回／月

３．操業終了時水洗い、周辺掃除（ プラ、鉛屑飛散）

＜巣鉛抜作業台＞

１．廃硫酸の排出、巣鉛の抜き出し、トップ、ケースの分別

２．液の抜けているバッテリーの巣鉛は、非常に抜きにくい。

＜ミスト回収設備＞

１．循環水の交換　　ＰＨリトマス試験紙で、２～４程度で交換（上水）

２．軸受け　　グリース　　１回／月

３．吸引状況確認

＜廃硫酸ピット＞

１．廃硫酸　　２０％、そのうち３～５％位は、巣鉛が持って行く。

２．ピット上部　　プラ屑が浮く

３．ピット下部　　鉛粉が沈む

＜巣鉛＞

１．廃硫酸が３～５日たれる。

3-1-1-H「巢鉛輸入許可証」

폐기물의 국가 간 이동 및 그 처리에 관한 법률 제10조 및 동법시행령 제9조 제11조 의 규정에 의하여 위와 같이 폐기물의 수입 ☑ 허 가 □ 변경허가를 신청합니다.

2008 년 02 월 13 일

신 청 인: 慶南 咸安郡 漆西面 溪內里 625-1
株式會社 和 昌
代表理事 鄭 錫 穆

낙동강유역환경청 귀하

수 수 료
폐기물의국가간이동및그처리에관한법률시행령 제20조의 규정에 의하여 산출한 금액
W3,078,000-

※ 구비서류

1. 당해 폐기물을 환경적으로 건전하게 관리한다는 내용과 수입가격이 선적가격(C.I.F.)으로 명시된 수입계약서 또는 주문서 1부
2. 수입폐기물의 특성과 용도를 표시하는 서류 1부
3. 수입폐기물의 운반경로·운반수단·운반업자가 표시된 국내운반계약서 1부
4. 폐기물의국가간이동및그처리에관한법률 제10조제6항의 규정에 의한 수입(포괄수입)의 경우에는 수입폐기물의 통관지세관, 수입예정일 또는 수입예정월별로 수입량이 기재된 포괄수입계획서 1부
5. 폐기물의국가간이동및그처리에관한법률시행령 제20조제2항의 규정에 의한 폐기물수입허가수수료 납부영수증 1부
6. 수입폐기물의 처리 또는 재활용 계획서(수입폐기물을 처리 또는 재활용하고자 하는 자는 폐기물처리업허가증 또는 재활용신고필증 사본을 포함한다.) 1부
7. <삭제>
8. <삭제>
9. 수입대행의 경우에는 수입대행계약서
10. 유해폐기물의국가간이동및그처리의통제에관한바젤협약 제6조제11항의 규정에 의한 보험증서 기타 보증서

※ 변경허가의 경우에는 그 변경내용을 증명하는 서류와 수입허가서 원본을 구비하여야 합니다.

허가번호	02-003-02-08-019	유효기간	2008.3.1-2009.2.24
변 경 사 항			
허 가 조 건	"준수사항을 이행할 것."		

폐기물의국가간이동및그처리에관한법률 제10조 및 동법시행령 제9조 제11조 의 규정에 의하여 위와 같이 폐기물의 수입을 ☑ 허 가 □ 변경허가 합니다.

2008 년 2 월 21 일

낙동강유역환경청장

株式会社　和昌　本社
鉛製錬工場

工場社屋

工場建屋

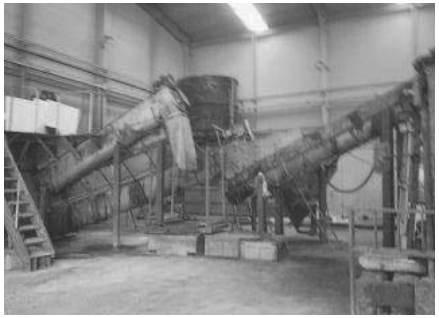
プラント設備

3-1-1-1「韓国製錬会社写真」

バッテリー解体処理施設




廃酸タンク

インゴット製造釜


中和タンク


巣鉛ヤード

巣鉛原料投入

インゴット製造工程

インゴット製品

→ 各バッテリーメーカーへ納品

主要納品先： セバン電池社（G＆Yu）
諸外国バッテリーメーカー

USA.輸入バッテリー（車用）

USA.輸入バッテリー（産業用）

USA.輸入バッテリー（産業用）

納入数量3500t/月

内訳
概ね　アメリカ　ロサンゼルス
　　バッテリーメーカーより輸入

　　日本は㈱美星 と契約輸入

プラスチックと廃酸を除去している

日本輸出バッテリーストック（車用）

廃バッテリーバンニング

㈲ファイブ・スター 輸出

八戸貿易港（海上コンテナ）

レターおよび
MOU（覚書）

Letter 1: NEMA (National Environment Management Authority)

nema
mazingira yetu | uhai wetu | wajibu wetu

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

Tel: (254-020)-6005522 / 3 / 6 / 7, 6001945, 6008767
Mobile line: 0724 253 398, 0723 363 010, 0735 013 046, 0735 010 237
Telkom Wireless: 020-2101370
Fax: (254-020)-6008997
Hotline: 020-8077233, 020-6006041

P. O. Box 67839 - 00200
Popo Road, Nairobi, Kenya
E-mail: dgnema@nema.go.ke
website: www.nema.go.ke

NEMA/14/15 VOL I

23rd December 2013

Mr. Yasuo Kimura
President, Evergreen Co., Ltd.
133 Kamishirono, Shinorocho, Kita-ku,
Sapporo City, Hokkaido, JAPAN, 002-8052
Tel/Fax: +81 (0)11 773 5550
Email: evergreen@sound.ocn.ne.jp

Dear Sir

LETTER OF INTENT FOR A LEAD BATTERY RECYCLING PROJECT IN THE REPUBLIC OF KENYA

It was a great pleasure to have received a courtesy visit from your delegation in my office on Wednesday, 6 November 2013. Am also pleased that I was able to introduce your delegation to the Principal Secretary of Ministry of Environment, Water and Natural Resources and subsequently met with the Principal Secretary of Ministry of Devolution and Planning.

During our discussions, I noted that your proposed project on lead battery recycling in Kenya will have a great impact in employment creation. Moreover, I assume that your project will demonstrate a very good example when developing an environmental guideline on waste battery management in Kenya. I hope that the project will enable the Japanese technologies and experiences in the relevant field to contribute to the improvement of the environmental standards of this country.

National Environment Management Authority will support your initiative in issues of environmental compliance and sustainable development. Please feel free to contact us should you have any other requests.

Yours sincerely,

GEOFFREY WAHUNGU
DIRECTOR GENERAL

Letter 2: Safaricom

Mr. Yasuo Kimura,

President, Evergreen Co. Ltd

133 Kamishirono, Shinorocho, Kita-chu

Sapporo city, Hokkaido Japan, 002-8052

Tel/fax: +81(0)117735550

Email:evergreen@sound.ocn.ne.jp

15th January 2014

Dear Sir,

RE: LEAD BATTERY RECYLING PROJECT

Thank you for visiting Safaricom and seeing its facilities that use lead batteries. As you may be aware, recycling has become a major issue for more and more industries as they have realized the importance of preserving our limited natural resources.

Battery materials pose no threat to human health when in use, but batteries discarded improperly can have dangerous health and environmental consequences because of the heavy metals the batteries contain. In light of this, we have put in place an environmental management policy that guides the company in disposal of used lead batteries.

We would like to thank you for expressing interest in assisting Safaricom dispose of its used lead batteries in your recycling plant for proper treatment . We look forward to partnering with you in future.

Yours faithfully,

FOR: SAFARICOM LIMITED

KAREN BASIYE

Senior manager- Sustainability Reporting & Environment Compliance

Corporate Affairs Division

Stantech Motors

driving you into the future

Mombasa Rd, Next to Mantrac
P.O. Box 78710 - 00507, Nairobi.

Service / Accident Division:
Pilot Line: 8045683/4/5
Fax: 020 8070407, 2613676
Mobile: 0728-742424/10, 0732-629536
0722 891659, 0733 854847
Email: service@stantechmotors.co.ke
Email: accident@stantechmotors.co.ke

New Vehicles Sales Division:
Tel: 020 8045682, 8070402
Mobile: 0728 736736
Email: sales@stantechmotors.co.ke
Website: www.stantechmotors.co.ke

13th January 2014

Mr. Yasuo Kimura
President, Evergreen Co., Ltd.
133 Kamishirono, Shinorocho, Kita-ku,
Sapporo City, Hokkaido, JAPAN, 002-8052
Tel/Fax: +81 (0)11 773 5550
Email: evergreen@sound.ocn.ne.jp

Dear Sir,

RE: Letter of Intent for your lead battery recycling project.

I wish to express my sincere appreciation to your delegations for the visit you conducted to our office and automobile repairing garage on November 2rd, 2013. Given your presentation on your new business model, followed by a series of discussions, I acknowledge that your business will make a great contribution to the recycling process of waste batteries in our country. As one of the leading vehicle repairers in Kenya, our company has been questing for an ethical way to dispose the waste batteries, and your system would be an ideal one to do so. Hence, I hereby would like to disclose our company's great interest in supplying your company with waste batteries if every necessary condition shall meet. I am even hoping that our company will become the role model for our colleagues in the industry as a socially and environmentally responsible enterprise by working closely with your project.

Thank you very much once again for your interest in collaborating with us, and I wish to continue further discussions on the relevant topic very soon.

Yours sincerely,

Titus M. B. Ntuchiu
MANAGING DIRECTOR

Letter 4: Premier Industries Ltd

Premier Industries Ltd

Baba Dogo Road, Ruaraka,
P.O. Box 22460 Post Code: 00400
Nairobi, Kenya.

Mobile: +254 722 511173, 734 511173
+254 722 557483, 772 557483
Tel: 8562260 / 0202519611 / 0202664526
Email: info@premierindltd.com
sales@premierindltd.com
Website: www.premierindltd.com

20th January, 2014

Mr. Yasuo Kimura
President, Evergreen Co. Ltd.
133 Kamishirano, Shinorocho, Kita – Ku,
Sapporo City, Hokkaido,
Japan, 002 - 8052

Dear Sir,

RE: EXPRESSION OF INTEREST FOR YOUR LEAD BATTERY RECYCLING PROJECT:

I refer to our meeting of 19th December 2013 in our offices, and would like to express interest in purchasing the shredded plastic from the waste battery disassembling plant, that is expected to be established by your company.

The samples that you showed us do meet our quality standards, we therefore find your prospective business model very interesting and if all the conditions are favourable, we would be looking forward to procure the shredded plastics from your company.

We look forward to a healthy business partnership.

Yours Faithfully,

DIRECTOR.

Memorandum of Understanding

Between

Machakos County Government, having its offices at Government of Machakos, P.O. Box: 1996-90100, Machakos, Kenya, duly represented by its Governor, Dr. Alfred Nganga Mutua *(hereinafter referred to as the "Governor")*

And

Evergreen Co. Ltd. *(hereinafter referred to as "Evergreen")*, having its offices at 133, Kamishinoro, Shinorocho-cho, Kita-ku, Sapporo-shi, Hokkaido, Japan, duly represented by its President, Mr. Yasuo Kimura.

HEREINAFTER also referred to collectively as the "Parties".

WHEREAS:

A. Evergreen is the experienced waste battery recycler that has the technical expertise to disassemble waste batteries into lead plates and plastic, and apply environmental management system to the disassembling process.
B. Machakos County Government is interested in launching a new public utility project in waste battery recycling.
C. Parties have, for mutual gain, agreed to cooperate in the establishment and operation of a waste battery disassembling plant and machineries (the "*Plant*") if Evergreen's effort should turn into an Official Development Assistance (ODA) project between the Government of Kenya and the Government of Japan (*the "Project"*).
D. This Memorandum of Understanding *(the "MoU")* is not legally binding. The purpose of this MoU is that Parties acknowledge general principles and directions of the Project in order to avoid a misunderstanding of both Parties' interest at a later stage of the process. Contrarily, the details of this agreement should be outlined in a legally binding document by and between the Parties and other stakeholders after the Project should be adopted.

This MoU refers to a high-level meeting *(the "Meeting")*, which was held by Dr. Sunil Kumar Dhall, Minister, Department of Trade, Economic, Planning and Industrialization of Machakos County Government, and Mr. Yasuo Kimura, President, Evergreen on 3 December 2013 in the liaison office of Machakos County Government in Nairobi, Kenya. As requested by the Minister, a project briefing document, which was used in the Meeting, was also provided to the Deputy Governor of Machakos County, His Exellency of Bana KIALA on 4 December 2013. In the Meeting, Parties agreed on signing this MoU in order to emphasize the following principles and directions of the Project if adopted.

1. Parties are expected to be signers (with other relevant authorities and organizations jointly) of the Project .

2. Machakos County Government should:
   2.1 At the beginning of the Project, provide two-acre land, which should be appropriate for the Plant considering availability of electricity and water, distance from Nairobi City and residential areas, ways from main roads, etc.
   2.2 During the Project, supervise the establishment of the Plant jointly with Evergreen.

2.3 After the Project period, operate and maintain the Plant properly and permanently under Machakos County Government's responsibility as the owner of all the assets of the Project. For proper maintenance and operation, the Governor expects Evergreen to provide technical assistance which should be agreed at the end of the Project period ("*Further Agreements*").

3. Evergreen should:
   3.1 At the beginning of the Project, design the Plant and bring it into Machakos County.
   3.2 During the Project, (a) supervise jointly the establishment of the Plant, and (b) help an initial operation of the Plant, which includes, but is not limited to collecting and disassembling waste batteries as well as developing an environmental management system.
   3.3 After the Project period, under Further Agreements between Parties, carry out an effective operation and management of the Plant, including training employees and providing technical support.

This MoU shall be made effective as of the **15th day of January 2014** (*the "Effective Date"*) by and between the Parties.

IN WITNESS WHEREOF, the parties hereto have caused this agreement to be signed by their duly authorized representative of each party, all done on the day and year above written.

Signed on behalf of Governor, Machakos County Government	**Signed on behalf of** Evergreen Co. Ltd.
Name / Title: Dr. Alfred Nganga Mutua	Name: Mr. Yasuo Kimura / President
Signature:	Signature:

Draft Letter 1: Added Performance Kenya Ltd.

Sultan Lalji
Managing Directo
Added Performance Kenya Ltd.
P.O. Box xxxx – xxxx, Nairobi, Kenya
Phone number: +254 xxxxxxxxxx

Logo, etc.

Date:

Mr. Yasuo Kimura
President, Evergreen Co., Ltd.
133 Kamishirono, Shinorocho, Kita-ku,
Sapporo City, Hokkaido, JAPAN, 002-8052
Tel/Fax: +81 (0)11 773 5550
Email: evergreen@sound.ocn.ne.jp

Dear Sir

RE: Letter of Intent for your lead battery recycling project

First of all, I highly appreciate our meeting that took place in December, 2013. It was very insightful, and I am glad to learn that your company and our company share various values in common.

As had been discussed in our meeting, I would like to express our interest in procuring lead from the waste battery disassembling plant that you expect to establish in our country in the near future, if all the relevant and necessary conditions are to meet. I assume that your project will add not only social values to our business, but also, further credibility from our current and potential customers.

I wish to continue the further discussion regarding our business potential partnership, and I hope to see it being realized in the very near future.

Sincerely yours,

Sultan Lalji
Managing Director
Added Performance Kenya Ltd.

Draft Letter 2: General Motors East Africa Ltd.

xxx xxx (Name of a signer)
xxxxxx Manager
General Motors East Africa Ltd.
P.O. Box xxxx – xxxx, Nairobi, Kenya
Phone number: +254 xxxxxxxxxx

Logo, etc.

Date:

Mr. Yasuo Kimura
President, Evergreen Co., Ltd.
133 Kamishirono, Shinorocho, Kita-ku,
Sapporo City, Hokkaido, JAPAN, 002-8052
Tel/Fax: +81 (0)11 773 5550
Email: evergreen@sound.ocn.ne.jp

Dear Sir

RE: Letter of Intent for your lead battery recycling project

I hereby would like to express my deepest gratitude for visits of your delegation to our headquarter, garage and scrap yard in November 2013.

As a company which holds ISO 14001, environmental consideration is one of our top priorities. We have been making serious efforts in order to improve our environmental policies and practices, especially those in waste management. As one of our most ambitious challenges, our company has been trying to improve our waste management system, particularly for hazardous waste such as scrap batteries. For this, I consider that your waste battery disassembling plant and your business have great potentials to give a positive impact and a better solution.

Given the introductive presentation on your environmental management system, your new plant, your business plan and your expertise in the relevant field, I appreciate that your company is planning to launch such a project in Kenya. If relevant conditions are realized, I would assume that our company has a high possibility to start collaboration with your company, under which all the waste batteries disposed from our company are to be supplied to your battery disassembling plant.

I wish to begin the further discussion in the very near future.
Thank you very much once again for your interest in our company.

Sincerely yours,
Harrison Ogada
Buyer
General Motors East Africa Ltd.

Draft Letter 3: Kenya motor vehicle repairers association

xxx xxx (Name of a signer)
xxxxxx Manager
Kenya motor vehicle repairers association
P.O. Box xxxx- xxxx, Nairobi, Kenya
Phone number: +254 xxxxxxxxxx

Logo, etc.

Date: xxx xxx 2014

Mr. Yasuo Kimura
President, Evergreen Co., Ltd.
133 Kamishirono, Shinorocho, Kita-ku,
Sapporo City, Hokkaido, JAPAN, 002-8052
Tel/Fax: +81 (0)11 773 5550
Email: evergreen@sound.ocn.ne.jp

Dear Sir

RE: Letter of Intent for your lead battery recycling project

I highly appreciate the opportunity to have met your delegation in January 2014.
The battery recycling project that you intend to launch in Kenya will give a great impact on the waste management in our country. For Kenya Motor Vehicle Repairers Association and our ( ) member companies, it will be a valuable decision to participate in your projects, not only because the project will generate some income to our member companies, but also, because we will be able to make a significant social impact by providing you with waste batteries.

Herewith I would like to express our great interest in working closely with your project by encouraging our member companies to provide your company with waste batteries after the establishment of your battery disassembling plant.

Thank you once again for your interest in our association and our member companies.
I wish to continue our fruitful discussions in the coming months.

Sincerely yours,

Kenya motor vehicle repairers association

Draft Letter 4: Kenya motor industry association

xxx xxx (Name of a signer)
xxxxxx Manager
Kenya Motor Industry Association
P.O. Box xxxx- xxxx, Nairobi, Kenya
Phone number: +254 xxxxxxxxxx

Logo, etc.

Date: xxx xxx 2014

Mr. Yasuo Kimura
President, Evergreen Co., Ltd.
133 Kamishirono, Shinorocho, Kita-ku,
Sapporo City, Hokkaido, JAPAN, 002-8052
Tel/Fax: +81 (0)11 773 5550
Email: evergreen@sound.ocn.ne.jp

Dear Sir

RE: Expression of Interest in your lead battery recycling project

It was very beneficial to have had a chance to meet with you on on January th, 2014. I am glad that we could have a very constructive discussion. I greatly appreciate your battery recycling project, and I assume that the project will give a great impact on the waste management in our country.

Kenya Motor Industry Association consists of ( ) member companies, most of which are the dealers for the world's leading vehicle manufacturers. As many of our member companies are keen to establish themselves as socially responsible enterprises, it is predicted that they will be highly motivated in participating in your project by supplying you with waste batteries .

Herewith I would like to express our great interest in your project, and if the project is realized, our association will be glad to encourage our member companies to be a part of it as waste battery suppliers.

Once again, thank you very much for your attention.
I look forward to having further discussion with you.

Sincerely yours,

Kenya Motor Industry Association

面談記録