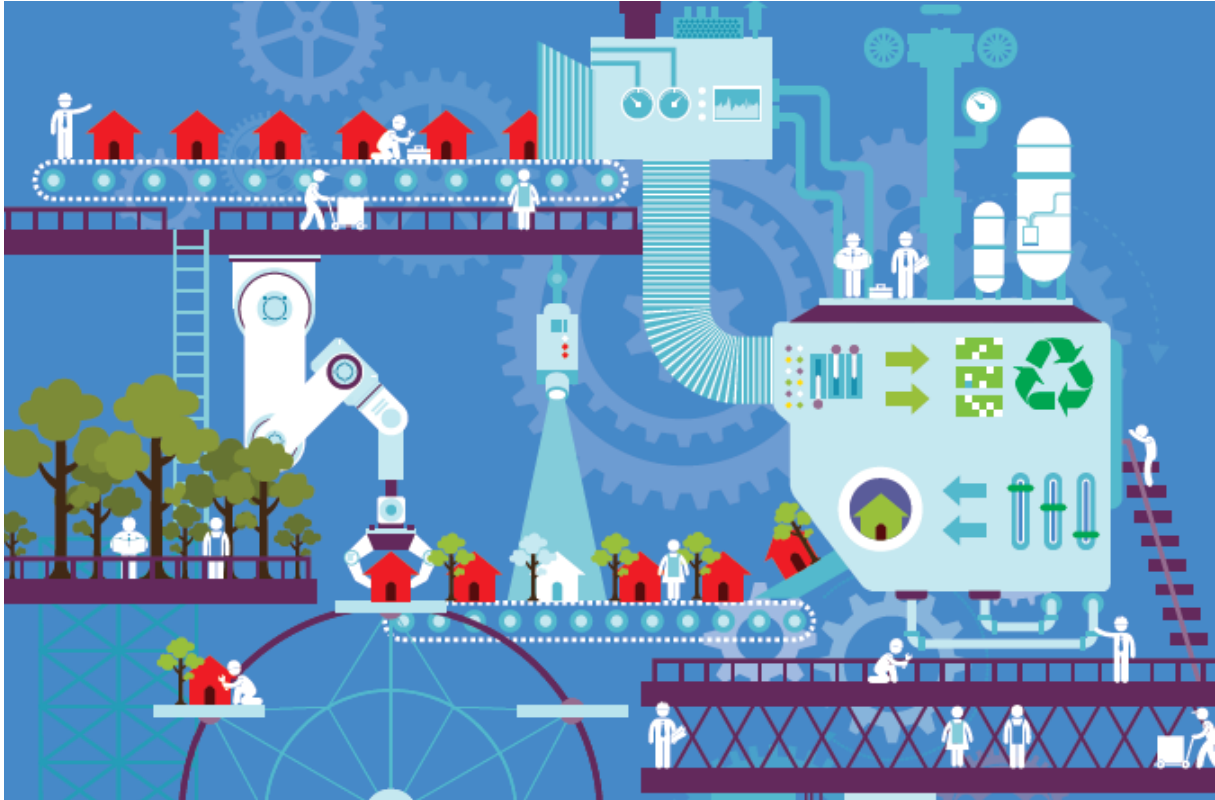


DEVELOPING SUSTAINABLE POLICY AND PROCESSING CAPACITY FOR END OF LIFE VEHICLES IN MONGOLIA



Arie de Jong

November 2017



UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION



1. ACKNOWLEDGEMENTS

I would like to thank the following persons and organizations that supported the project developing sustainable policy and processing capacity for end of life vehicles in Mongolia.

Many special thanks to

Mr. Dr. Bazarragchaa Ichinnorov, Executive director, Mongolian Automobile Recycler's Association, National consultant on ELV recycling and senior lecturer at the Mongolian University of Science and Technology, who explained the ELV matters in Mongolia and showed all related business. His guidance was great.

Ms. Altantsetseg Sodnomtseren, National Coordinator for PAGE in Mongolia, who organised the visits and meetings to gain the necessary information.

Further:

Ms. T. Bulgan, Director General of Green development policy and planning department, Ministry of Environment and Tourism.

Ms. Horolmaa, Ministry of Environment and Tourism.

Ms. Boyer, Ministry of Environment and Tourism.

Mr. Prof. Dr. Sc. D. Gotov, Adviser to Minister of Auto Transportation Policy implementation, department of Mongolia.

Mr. J. Sereeter Head of Division for Standards and Normative of the Policy and Planning Department, Ministry of Auto Transportation Policy.

Mr. T. Bravenec, Deputy CEO Golomt bank

Ms. T. Densmaa, Director Business Department, Business Department Division Golomt bank.

Mr. O.OCH, Director Project Finance Department Golomt bank.

Mr. B. Rentsendor, Founder and Chairman of GU Corporation.

Mr. B. Bilguudei, Head of Administration and Business Development Department, GU Corporation.

Ms. B Urtnasan, CEO Golden Universe Recycling LLC. (subsidiary of GU Corporation)

2. EXECUTIVE SUMMARY

Existing situation regarding ELV handling in Mongolia offers many opportunities. The Government is willing to work on initiatives to support sustainable ELV processing. Due to the size of the country, a beginning should be made in Ulaanbaatar and further rolled out after a successful start-up.

Extended Producer Responsibility should be adopted and changed into Extended Importer Responsibility; vehicle importers should pay a fee into a fully dedicated ELV recycling fund and a Private Public Partnership company (Vehicle Recycling Mongolia) should execute the ELV recycling process. The fee should be charged until the ELV business is mature and able to cover the recycling cost from the value of the ELV.

A set of ELV rules and standards must be formulated and authorised dismantlers appointed. The first appointed dismantlers should be supported with proper, state of the art recycling tools funded from the ELV recycling fund. This will create a showcase for other dismantlers.

Current dismantlers are also operating as a take-back network, but correct depollution does not take place, fluids and tyres are not well treated, only valuable parts are taken out. Due to the size and missing sales channels, the bodies are often left around. A shredder installation is needed to granulate the large pieces of metal, turning it into transportable, valuable steel scrap. E-waste can also be processed through a shredder. The shredder waste from both vehicles and e-waste, should be used as fuel in a cement kiln, destructing the Persistent Organic Pollutants (POP's).

Preferred option is having a shredder installation funded from the ELV recycling fund and sold to a private company after recovery of the start-up cost and having reached breakeven.

Currently, waste fluids are spoilt into the soil, used in private heaters or used in the road construction industry. A subsidiary from the GU Corporation has developed a governmental approved plan to extend a waste oil recycling plant also able to treat other waste fluids. This will create a solution for waste ELV fluids. Another approved plan is building a tyre recycling plant.

A lead-acid battery recycler only operates at mild outside temperatures. This facility and process needs expansion. For Prius hybrid batteries, having a strong positive value, recycling channels could be developed by the local industry.

Just outside Ulaanbaatar, a recycling area has been developed and constructed. Road connection has been realised, railway connection is planned. This strongly supports the area as a preferred location for authorised dismantlers and a shredder.

It is advised to develop an information technology driven payment check on the annual vehicle road tax and insurance and only have vehicles deregistered after proof of destruction, by means of a Certificate of Destruction (CoD) issued by an authorized dismantler, starting in Ulaanbaatar. This will force the last owner to deregister and dispose the vehicle at an authorized dismantler.

Recommended steps to set up a sustainable ELV recycling system

1. Create a temporarily ELV recycling fund through an additional recycling fee on vehicle imports and ensure sufficient payments into the ELV fund. As soon as a mature sustainable ELV system has been achieved, the value of the ELV might be sufficient to cover the recycling cost and the need for an ELV recycling fund should be reconsidered.
2. Establish "Vehicle Recycling Mongolia" as a Public Private Partnership (PPP) to execute Extended Importer Responsibility (EIR), funded from the ELV recycling fund.
3. Set up ELV Rules and standards by Vehicle Recycling Mongolia and the Government.
4. Design an IT system automatically checking and penalizing non-payers of the annual vehicle tax and insurance.
5. Appoint authorized dismantlers by Vehicle Recycling Mongolia.
6. Create a showcase by providing the first authorized dismantlers with appropriate tooling and fluid tanks funded from the ELV recycling fund.
7. Create a system to have ELV's deregistered only after proof of destruction from an authorized dismantler.
8. Continue and intensify the support of the subsidiaries of GU Corporation for setting up the planned tyre recycling plant, extending the capacity of the waste oil recycling plant and collecting & treatment channels for oil, other fluids and tyres.
9. Build a shredder installation financed from the ELV recycling fund and governmental loan or set up a complete and detailed business case to find investors in a shredder.
10. Support the battery recycler to expand his activities and plant facilities.
11. Start negotiations with the appropriate organisation in Japan to have the \$100 recycling fee paid in Japan transferred into the ELV recycling fund, for vehicles exported to Mongolia.

3. TABLE OF CONTENTS

	<i>Page</i>
1. ACKNOWLEDGEMENTS	2
2. EXECUTIVE SUMMARY	3
a. Recommended steps to set up a sustainable ELV recycling system	
3. TABLE OF CONTENTS	5
4. INTRODUCTION	6
a. Desired outcomes	
b. Project scope and exclusions	
5. MONGOLIA	8
6. SUSTAINABLE END OF LIFE VEHICLE PROCESSING	10
7. ELV PROCESS IN MONGOLIA	12
a. Current practice regarding end of life vehicles	
b. End of life vehicle legislation	
8. HAZARDOUS WASTE	16
a. Flame retardants	
b. Incineration	
c. Hazardous materials	
9. RECOMMENDATIONS	18
10.PROJECT PROPOSAL TO IMPLEMENT ACTIONS	23
a. Project objectives	
b. Action plan	
11.REFERENCES	26
12.ATTACHMENTS	27
a. Elements for ELV dismantler standards	

4. INTRODUCTION

United Nations Industrial Development Organization (UNIDO) is working together with a number of UN organizations, notably UNEP and UNDP, on an initiative called Partnership for Green Economy, PAGE. In PAGE assistant a number of priority countries are being advised on steps to move towards Green Economy from various angles.

In this context the Government of Mongolia asked assistance on doing diagnostic for and setting up end-of life vehicles processing. Another part of the request is to explore opportunities to destruct persistent organic pollutants (POP's) in electronic waste.

This report has been compiled to support Mongolia in developing policy and processing environmentally conscious capacity for end of life vehicles (ELV's) and to identify options to get POP's out of potential plastic recycling channels.

It describes:

1. Ideal process for end of life vehicles.
2. Current practices and material flows for end of life vehicles and the regulatory status in Mongolia.
3. Recommendations for action in the area of end of life vehicles and destructing POP's in Mongolia.
4. Project proposal for initiating to implement the actions.

Method

The analysis of the ELV situation and recommendations are based on existing information from the chairman of the Mongolian Automotive Recycles Association (MoARA), field investigation and interviews in Mongolia with delegates from two Ministries, recycling companies, internet research and knowledge and experience of mature ELV handling processes in Western Europe.

a. Desired outcomes

On final completion of the project, Mongolia will have a process in place which makes sure ELV's are dismantled in a sustainable way. ELV's will be depolluted by removing hazardous materials like batteries, tyres and fluids and valuable parts taking out taken out for reuse. Hazardous materials will be collected and treated in an environmental care-taking process.

The remaining body will be shredded, separating the metals from other materials used in the vehicle. Shredder waste, the non-metal part of the vehicle, will also be treated in an environmental care taking process. The metals will be recycled for new metal commodities.

Vehicle owners will be aware of the take-back network and their recycling obligations.

The process will also be applicable for electronic waste; disposed electronic devices and eliminating Persistent Organic Pollutants (POP's).

b. Project scope and exclusions

A detailed business plan with investments and return on sales is not part of this project. It has to be worked out separately with local experts and potential investors. Golamt Bank is willing to support the development of a business plan and to become a co-financing partner.

A few rough numbers have been mentioned to get an impression of the feasibility of the measures and steps. Detailed numbers are currently not available.

5. MONGOLIA

Mongolia is the 18th largest country in the world and has a population of around three million people. The country contains very little land that is suitable for agriculture, is it largely covered by grassland steppe with mountains in the north and the west and the Gobi Desert in the south. The capital Ulaanbaatar is the largest city where almost 50% of the total population live.

Mongolia joined the United Nations in 1961 and the World Trade Organization in 1997. With the UN membership Mongolia ensured its independence and sovereignty, safeguarded its security and strengthened its position in the international community. Mongolia is an active member of the UN, also participating and contributing in peacekeeping operations.

Most of the country is hot in the summer and extremely cold in the winter, with January averages dropping as low as -30°C . The annual average temperature in Ulaanbaatar is -1.3°C .

About 60% of the total population is under age 30, 25% of whom are under 14.

The official language of Mongolia is Mongolian, spoken by 95% of the population. In the west of the country, Kazakh and Tuvan, both Turkic languages, are also spoken.

Today, Mongolian is written using the Cyrillic alphabet, although in the past it was written using the Mongolian script.

Russian is the most frequently spoken foreign language in Mongolia, followed by English, although English is gradually replacing Russian as the second language.

Government and Legal system

Mongolia is a semi-presidential representative democratic republic, where the president is directly elected. The people also elect the deputies in the national assembly, the State Great Khural. The president appoints the prime minister, and nominates the ministers on proposal of the prime minister. The constitution of Mongolia guarantees a number of freedoms, including full freedom of expression and religion. Mongolia has a number of political parties; the largest are the Mongolian People's Party and the Democratic Party.

The President of Mongolia has functions like vetoing laws accepted by parliament, appointing judges and courts of justice and appointing ambassadors abroad. The parliament can override the veto by a two-thirds majority vote.

The legal system is made up of a three-tiered court system; courts in each provincial district and the Ulaanbaatar district; appeal courts for each province and Ulaanbaatar; and the Supreme Court of Mongolia. For questions of constitutional law there is a separate constitutional court.

A Judicial General Council (JGC) nominates judges which must be acknowledged by the parliament and appointed by the President.

Mongolia is divided into 21 provinces, which are in turn divided into 329 districts. The capital Ulaanbaatar is administrated separately as a capital city with provincial status.

Economy

Economic activities in Mongolia have traditionally been based on herding and agriculture and mining of mainly copper, coal, molybdenum, tin, tungsten, and gold. The grey economy is estimated to be at least one-third the size of the official economy. Mongolia is one of the countries with the most promising growth prospects.

Minerals represent more than 80% of Mongolia's exports, expected to rise to 95%. About 3,000 mining licenses have been issued. Mining is continuing to rise as a major industry of Mongolia. Chinese, Russian and Canadian firms have started mining businesses in Mongolia.

Many households in Mongolia live from livestock breeding. Most herders in Mongolia follow a pattern of nomadic or semi-nomadic pastoralism.

The Trans-Mongolian Railway, North - South and single track, is the main rail link between Mongolia and its neighbouring countries and the Trans-Siberian railway.

Mongolia has a number of domestic airports, some of them having international status. The main international airport is Chinggis Khaan International Airport, 20 km from downtown Ulaanbaatar. Direct flight connections exist between Mongolia and South Korea, China, Thailand, Hong Kong, Japan, Russia, Kyrgyzstan, and Turkey.

Many overland roads in Mongolia are only gravel roads or simple cross-country tracks. There are paved roads from Ulaanbaatar to the Russian and Chinese border and from Ulaanbaatar east- and westward. A number of road construction projects are currently underway. The kilometres of paved roads is rapidly growing.

Ulaanbaatar has the second-most fine particle pollution of any city in the world. Poor air quality is also the largest occupational hazard, as over two-thirds of occupational disease in Mongolia is dust induced chronic bronchitis.

6. SUSTAINABLE END OF LIFE VEHICLE PROCESSING

Vehicles are voluminous objects containing environmental hazardous parts and fluids/gasses. Several parts may also contain flame retardants or Persistent Organic Pollutants (POP's). Proper handling at end of life stage is important. An end of life vehicle also often contains valuable parts and materials.

Environmental hazardous parts are among other things, batteries, mercury switches, airbags, belt tensioners, fuel and oil containing parts like fuel tank, engine, transmission & shock absorbers, brake cylinders, tyres and components holding engine coolant, windscreen fluid and refrigerant gas. Other hazardous substances, not directly visible are the POP's which might be found in foam from seatings and plastics.

Valuable parts are components that can be used to put on and repair other vehicles or are used for other purposes. Depending on the existing vehicle market, parts may classify for reuse. Examples of large valuable parts and components are engines, transmissions, axles, alternators, sheet metal, steering gear and lightning components. However, small parts are also reused.

High value parts for material reuse or recycling are for example catalysts, batteries, wiring loom and aluminium parts from radiators and engine components.

At end of life stage of a vehicle, all the environmental hazardous parts must be removed, fluids/gasses must be drained and POP's eliminated.

Before an end of life vehicle can be treated, it needs to be collected and transported to a dismantler. A take-back network is essential to get an end of life vehicle off the street or preventing it is illegally dumped or left. End of life vehicles usually represent a positive value due to the parts and reusable materials. This value can be used as a fee to reward the last owner to get his end of life vehicle to a collector or dismantler. Owners of end of life vehicles should also be aware of the take back possibilities and opportunities.

An company which takes back end of life vehicles needs a business link to a dismantler who accepts or buys the units.

A dismantler removes valuable parts and materials for sales purposes; environmental hazardous parts and fluids/gasses must also be removed, this is the actual depollution. If there is no specific reason or obligation for the dismantler to do so, it might be left in the vehicle and cost are saved because mostly it has a negative value. This is an important stage in the recycling process. Collection and correct treatment of the environmental hazardous parts and fluids must also be organized to make sure it does not end up at unwanted places, again saving cost.

The remainder of a dismantled vehicle or depolluted body is sold to a shredder company or indirectly via a metal trader. A metal trader collects metal scrap for sale to metal recyclers or shredders.

A shredder operation requires heavy machinery and infrastructural investment. Sufficient volume of shredder input material is necessary for a profitable operation. A shredder granulates the vehicle into fist sized pieces. The small pieces are required to feed a blast furnace/steel mill or arc melting furnace. The shredder uses magnets and air flow to separate the ferrous and non-ferrous metals from the other materials like plastics, glass, pieces of stone and rust, rubbers and fibres from door panels, carpet, headliner and foam from seatings. The shredder company needs sales channels for shred metals, where the metals are recycled into new metal commodities.

The non-metals, the shredder waste can be treated in different ways. In several countries it is landfilled, this is more and more outlawed. A more favourable solution is applying a screen to sieve the shredder waste into a mineral fraction, containing pieces up to about 15 mm, accepted for landfill and a residue which is incinerated. In this way, POP's in foam and plastics are destroyed.

Cheaper alternative but less used instead of the shredder process is applying a metal shear to cut the body into pieces. The ferrous and the non-ferrous are not separated from the non-metals and put together into the metal melting furnace. This creates contamination in the melted metal and steel mill air pollution. Most steel mills and smelters do not accept this contaminated scrap anymore. In many countries the car shearing process is prohibited for air emission and the impossibility to have a wreck identified after shearing.

Many different types of electronic waste can also be processed in a shredder. The metals and waste are comparable to vehicles and handled the same way. Examples are washing machines, heaters, computers and related appliances, electric tools and TV's (after removal of the cathode ray tube). Incineration of this shredder fluff will eliminate all POP's.

The best sustainable method for processing shredder waste is Post Shredder Treatment in a so called PST-plant. In this quite expensive operation, the shredder waste is sorted into about 20 different output fractions which can be applied as secondary raw materials for new products. Sorting takes place using mills, airflow, magnets, screening, bouncing and sink/float separating techniques. Main output streams are the copper from small pieces of wiring, pieces of aluminium, plastics, minerals (stones, glass) and fibres from the textile and foam parts in a vehicle. However, fibres and plastic streams must be checked for POP's.

Using PST, the vehicle can be recycled way over 95% of the original vehicle weight.

7. ELV PROCES IN MONGOLIA

Current practice regarding end of life vehicles

Mongolian has about 800.000 registered vehicles. For only 550.000, the annual tax and insurance is paid, 250.000 vehicles are missing and might have turned into an ELV. An legally regulated ELV process doesn't exist in Mongolia. However, many small workshops, entrepreneurs and private persons are involved in incomplete recycling of vehicles. Used parts business is large, not only Mongolian ELV's are dismantled for used parts; used parts are also imported from the vehicle suppling countries, mainly Japan. After dismantling the valuable parts, the body is often left in a place next to the workshop or house.



Car bodies left around the house

The dismantled ELV's are stock piled this way because the voluminous bodies are not easy to transport and not suitable for the blast furnace steel plant about 200 km north of Ulaanbaatar. If the body size has been partly reduced, it might end up at a scrap steel trader and transported by truck to China or Russia. Bodies are generally not dumped on a landfill or dumpsite in Mongolia.



Car body parts at a scrap metal trader

Another ELV stream are waste motor cycles. About 40.000 used bikes are yearly imported and often only used for a very short period of time, this might even be only one year.

Take-back network, dismantling, depollution and shredding

Although an official take-back network for handling ELV's is not available in Mongolia, take back of an ELV is not an issue, it is the recycling of the body which stops the process.

There are currently no well-equipped dismantlers seriously depolluting the vehicles and no shredders to granulate the body and to separate the metals.

Aluminium parts are sold to a company where the metal is melted and turned into pots and sold to aluminium applying industry.

Correct depollution of the ELV's is not conducted very well or not at all. If the fluids are not dumped in a waste stream or soil, it is mixed with waste oils or used in housing heating systems. Waste and contaminated oil is also collected and used for road construction to produce tarmac. This application is not environmental friendly, waste oil and the mixed other fluids are clearly hazardous waste.

A oil recycling company Golden Universe Group LLC, part of the GU Corporation, located in Bagakhangai, district of Ulaanbaatar is currently recycling waste oil from mining industry trucks. It has an approved construction plan with an almost finalised financing scheme to largely increase the waste oil recycling capacity. Main output stream is high quality diesel oil.

After implementation, there will be sufficient capacity to recycle waste oil from the dismantlers, workshops and garages in Ulaanbaatar. Golden Universe Group is also developing a plan for bulk waste oil storage in Ulaanbaatar and collecting waste oil from dismantlers, workshops and garages in Ulaanbaatar.

The collection should be free of charge for the disposing party, or even given a small cost reimbursement, otherwise dumping or mixing will still continue. The collecting could easily be combined with gathering the other waste fluids. This is also proposed by the Golden Universe Group.

For climate reasons, each car gets an oil change twice a year. The potential amount of waste oil to recycle is about 4 million litres annually.

Plastics are sometimes dismantled and exported to China for recycling.

Battery recycling

Waste lead-acid batteries are, next to illegal export to China, mainly sold to a recycler, who separates the acid from the lead and plastic battery casing. The acid is sold to the mining industry, the lead is melted to bars and sold to recyclers outside Mongolia. The plastic from the battery casing is sold to plastic recyclers in China. Lead has a high positive value. Dumping is not likely. This process was confirmed by used battery traders. The Mongolian battery recycling plant is a construction only equipped with a roof without proper walls and operates therefore only at mild outside temperatures. This could easily be improved, with special attention for potential high toxic lead fumes.

Batteries from hybrid electronic vehicles, Nickel-metal-hydride (Ni-MH) and Lithium Ion (Li-ion) are sold among others to nomads who use them in a second life stage for solar energy storage. Not many of these batteries have been applied yet for second use. How these are finally disposed is not known.

The Toyota Prius (model 2) in Mongolia is equipped with a Ni-MH battery. Old Ni-MH batteries have a high positive value due to the valuable and recyclable metal content. It is expected that the business will grow as soon as more batteries become available.

Tyre recycling

About 700.000 vehicle tyres are annually turning into waste. The estimated amount of end of life tyres in Mongolia is 2,3 million units. In the mining industry area, waste tyres might be dumped in the ground.

On several sites, waste tyres are just left or dumped.



End of life tyres, just left somewhere

Worn tyres, if not dumped somewhere, are used for marking land sides or firewood. Also a tyre recycling company collects end of life tyres and after shredding, the granulate is used to produce mats. A tyre shredder is not suitable for car bodies.

The company Golden Universe Recycling LLC, part of the GU Corporation, has an approved plan which still needs financing to establish a pyrolysis plant for tyres in the Eco-Area of Ulaanbaatar. Process output is iron, carbon black and pyrolysis oil. Worn tyres from mining trucks are already collected and stored for treatment. After implementation, waste tyres from vehicles on the road and ELV's in Ulaanbaatar will be collected for pyrolysis as well. A mobile tyre shredder will be used for cutting and decreasing the size of the car and large mining truck tyres before they are put into the pyrolysis process.

End of life vehicle legislation

Mongolia doesn't have ELV legislation, only rules for hazardous waste. This law has currently been adjusted. Hazardous waste must be delivered at disposers cost at a facility and gate fees might be charged for taking and processing hazardous waste.

Like in many other countries, enforcement of existing rules however is difficult.

Missing knowledge and insufficient inspectors is a known issue. An ELV system should be able to operate as much as possible without requiring enforcement.

8. HAZARDOUS WASTE

Safe and sustainable dismantling

Car manufacturers are obliged to publish instructions how to safely dismantle their vehicles. This information system called IDIS is available on Internet and can be consulted by anyone. Most dismantlers are not aware or just not using the system.

Flame retardants

Flame retardants, also indicated as Persistent Organic Pollutants (POP's) were applied for a long time among other products in vehicles. Following the Stockholm Convention, POP's should be destructed and not return in the new products. In a vehicle, foam in seats and plastics have been treated with flame retardants for a long period. Incineration is probably the best solution for final destruction of the POP's.

E-waste from tooling, household appliances like white goods, coffee makers etc., also often contain POP's. These should also be destructed.

Incineration

A save solution for handling hazardous waste is often controlled incineration. Most waste from vehicles contain organic material. Waste to Energy (WTE) is a well-known and developed process. If the non-metals from a vehicle, plastics, fibres and foam, are separated from the metals, WTE would be a good solution for the non-metals and destruct POP's.

A regular WTE plant is able to perform this task, however mainly processing waste from households. A WTE plant for household waste is planned but not yet present in Mongolia.

Another WTE application is found in a cement kiln. Producing cement takes very much energy, which can also be obtained from non-standard fuels like oil and coal. Rubber tyre chips, plastics, foam and textile fibres are very suitable for providing energy. Cement kilns are present on several places in Mongolia. To avoid potential creation of dioxins in the lower temperature exhaust fumes of a cement kiln, appropriate filters must be installed. It is important to make sure that copper as catalyst for creating dioxins is accumulated in the filters.

Hazardous materials

Lead-acid batteries

Best process to handle lead-acid batteries is separating the lead, plastic and acid for recycling. Due to the value, this is generally not an issue. Melting lead however should be handled with care due to highly toxic fumes.

Li-Ion and Ni-MH batteries

Li-Ion and Ni-MH batteries are often suitable for second use in stationary application. Decrease in capacity is not an issue for this purpose. After second use for example storing solar energy, a Ni-MH battery has still a high positive value, recycling companies will step in collecting and trading. An old Li-Ion battery has a negative value. These batteries are mainly used in electric vehicles, which are not used in Mongolia. In the current Mongolian hybrid car park, Ni-MH batteries are applied.

Fluids

Oil must be drained and recycled. If the plans of the Golden Universe Group are realised, the oil will be recycled in a sustainable way.

Brake fluid and engine coolant have a negative value also due to transportation cost. Air-conditioning fluid, having a negative value as well, must be removed and treated safely and sustainably. For the non-oil fluids, Golden Universe Group can also easily provide the solution for collection and recycling in Ulaanbaatar. The cost for this should be covered to make it a viable business.

Catalytic convertors

Catalytic convertors have a high positive value, trade companies organize the collection and recycling.

Airbags and belt tensioners

Airbags and belt tensioners should be detonated before other recycling processes are applied. Practical experience in other countries shows this is not done and not creating accidents in metal recycling processes. However, ruling should be to detonate before other recycling steps are applied.

Mercury

Use of Mercury in a car switch has been prohibited since 2008, however, several manufacturers already banned it before. The switches must be dismantled manually and treated with care following manufacturers instruction. In the Mongolian car park, Mercury switches are practically not used.

Asbestos

Since 1999, use of asbestos in car parts is prohibited. Any asbestos left in old vehicles will be destroyed during incineration at high temperatures e.g. melting iron or in a cement kiln process.

Lead for wheel balancing

Lead for wheel balancing has been stopped latest in 2009, but might still be used in unofficial workshops. In this configuration, it is not a hazardous treat. It might be collected for the value or will end up in a metal smelter.

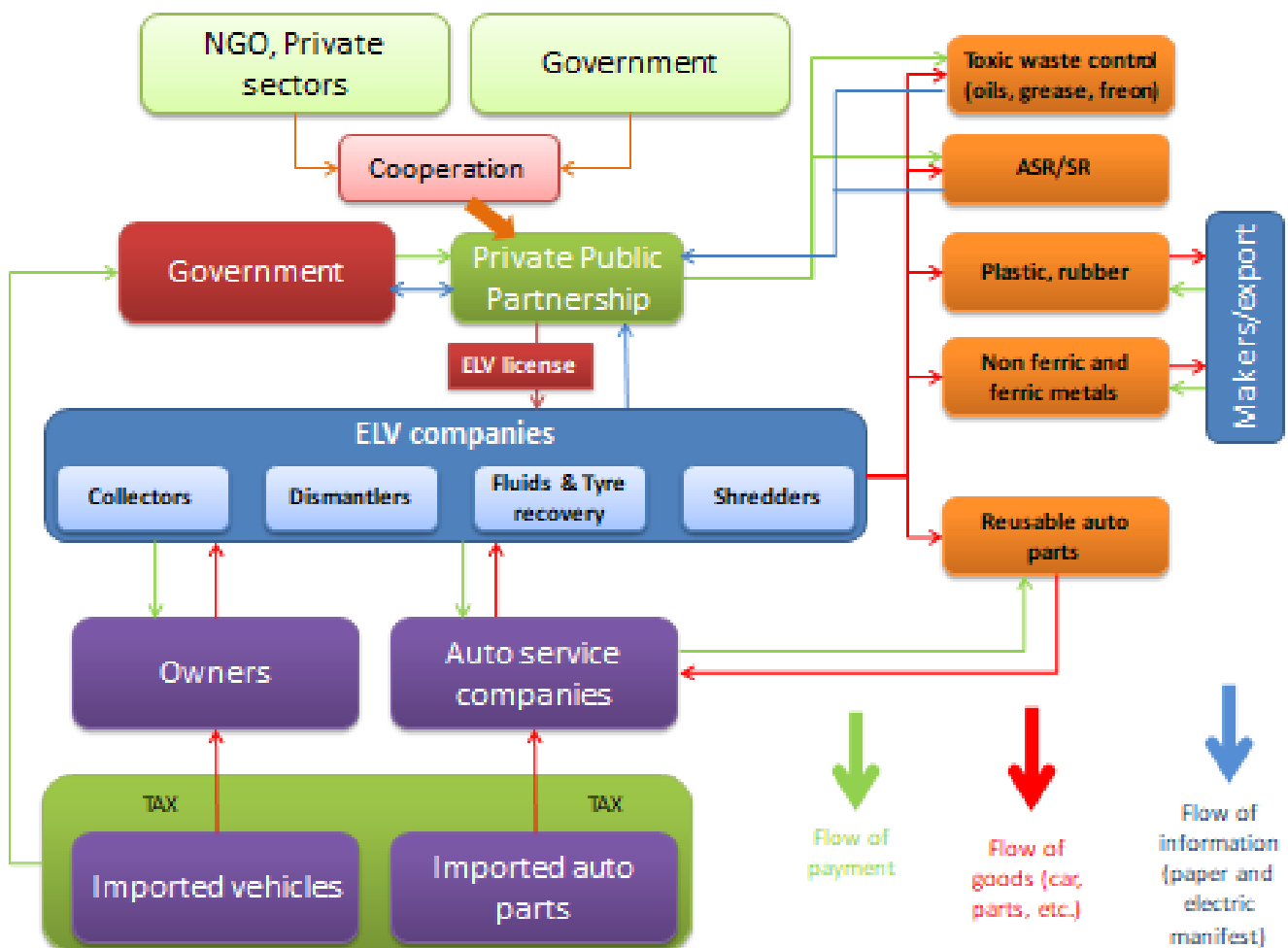
9. RECOMMENDATIONS

Creating a state of the art network for ELV processing and handling in Mongolia takes several steps. All measures and rules cannot be realised at once. However, it is very positive that the Mongolian Government is willing to make strong progress towards sustainable ELV recycling. It is advised to start in the Ulaanbaatar district where estimated 75% of all Mongolian vehicles are located.

Extended Producer Responsibility (EPR)

Since many independent parties are importing used vehicles in Mongolia, EPR for vehicles will not much contribute to ELV handling. It will practically not be possible to make all the manufactures or importers responsible for the end of life phase of the vehicles they have imported. If the execution of EPR scheme for ELV's is taken over by a third party, financed by all vehicle importers, it is turned into an Extended Importer Responsibility (EIR) program.

A flow diagram has been composed with a proposed ELV process for Mongolia.



ELV process flow

National standards for handling ELV's

Starting point for sustainable vehicle recycling is a set of ELV rules and regulations which are not yet in place. From here, recycling initiatives will be easier and should also financially be supported. In a meeting at the Minister of Auto Transportation Policy implementation, it was confirmed that the Government is open for rulings regarding ELV's.

Since Russia and China, the 2 bordering countries, do not allow import or hazardous waste passing their countries borders, even when recycling at final destination is proven, Mongolia has to find solutions for this type of waste. This is now landfilled.

Authorized dismantlers should be appointed. Authorized means that they fulfil specific standards before they receive an ELV licence. These should include: an impervious floor, oil/water/sludge separator, depollution tooling, storage for waste fluids and other waste like tyres, contracts with approved waste collectors, instructed mechanics and safety and security measures. A listing can be found in the attachment "Basic ELV Dismantler standards".

Investment in proper state of the art depollution tools, must be financially supported for at least the first authorized dismantlers.

Without firm enforcement, waste is attractive to handle at lower standards, increasing profit. Experience in Western Europe shows this unmistakably. Compulsory bookkeeping and a mass balance for waste streams would support enforcement opportunities.

If an additional recycling fee on the import of cars, road tax and or annual insurance can be collected and put into an ELV recycling fund, negative waste streams can be financially supported to prevent dump or other environmental damaging activities. Due to the relatively low cost for insurance and road tax, a recycling fee on car imports is preferable.

A Private Public Partnership organisation should be founded (called for example "Vehicle Recycling Mongolia") to execute the EIR and to make sure the correct expenditures are made. The organisation will also organise the collection and treatment of negative value waste streams.

Take-back network and shredder

A business opportunity to trade vehicles for recycling is starting point. In Mongolia, many parties are interested in the ELV for used parts, but do not have a solution for the body.

Due to the amount of metal, a body has a positive value, but apparently no party has identified business opportunities. Bodies are left everywhere. Only few smaller sized bodies parts end up in scrap steel at a metal trader and exported by truck to China or Russia.

If the body can be granulated, the obtained metal scrap will be interesting for the steel producing industry. Transportation will be, due to the volume reduction, covered by the metal value, even to Russia or China.

To get this process started, a shredder is needed. This requires an investment for the shredder installation of about \$2,5 million, but due to additional cost for land, building, infrastructure (railway connection), power supply, dedusting etc. it might total up to over \$10 million.

Before the investment is made, a clear business case must be developed. Supply of the shredder scrap materials and sales channels are crucial to obtain a profitable business. The number of annual available ELV's and motorcycles has to be determined.

If a business case is viable, the Golomt bank is willing to partner the project if at least 50% private equity is available and the Government is supporting the project with financial incentives like for example a vehicle scrappage program to get old vehicles off the road. Golomt bank has indicated to have several contacts with potential investors who would be interested in the project.

However, preferred option is having a shredder installation funded from the ELV recycling fund and sold to a private company after having reached breakeven and recovered the start-up cost. This would speed up the process since not all data for the business plan will be easily obtained or are just not available.

The shredder should also be used for processing electronic waste, separating the metals and non-metals containing POP's. The size of this annual waste stream has to be determined as well.

Shredder waste treatment

Best treatment of shredder waste is post shredder treatment/technology (PST). Only few PST plants are in operation worldwide. Operating a PST plant is costly and requires a mature ELV process.

It is recommended not to invest in PST before the other components of the ELV chain are in full operation. For the time being shredder waste should still be incinerated in a cement kiln.

Cement kiln

Incineration of automotive shredder residue (ASR), but also shredder residue from e-waste (SR) can be used very well for fuel in a regular cement kiln. In this way any POP's and asbestos will be destructed. In Mongolia several cement kilns are present, it needs investigation if all can use alternative fuels.

Oil

An oil recycling company, Golden Universe Group LLC, part of GU Corporation in Bagakhangai, about 85 km outside Ulaanbaatar is currently recycling waste oil from mining industry trucks. It has a governmental approved and almost financed construction plan to increase the recycling capacity. Main output stream is high quality diesel oil.

After implementation, oil from the dismantlers, workshops and garages in Ulaanbaatar can also be recycled.

Golden Universe Group is developing a plan for bulk waste oil storage in Ulaanbaatar and collecting waste oil from the dismantlers, workshops and garages in Ulaanbaatar. This initiative must be strongly supported.

Other fluids

Due to the relatively small vehicle park in Mongolia and enormous distances, the volume of waste fluids other than oil from vehicles is limited and transportation is expensive. Dismantlers, workshops and garages are not likely willing to cover the cost for collection and treatment of the fluids and cheaper, environmentally unsustainable disposal might be applied.

To ensure and maximize treatment, the cost for the dismantler should be zero and collection and treatment organized by another party to ensure proper procedures.

Sales channels for these fluids to neighbouring countries is not possible, it is considered as hazardous.

Golden Universe Group has confirmed it is able to treat the non-oil vehicle fluids as well. The company should be very strongly supported to start collecting and treating the fluids, next to the waste oil. As indicated in the model on page 18, financial support is required to implement this process. This requires a ELV recycling fund.

Tyres

As soon as the company Golden Universe Recycling has established its pyrolysis plant for tyres in the Eco-Area of Ulaanbaatar, tyres can be collected and recycled in a sustainable way.

Recycling area

Outside Ulaanbaatar, a recycling area has been developed and constructed ready for use. Vehicle inspection centre, Registration Office and Insurers are already located at the location. Dismantlers should be established in this zone as well, creating an ideal area for building a shredder installation. Used parts traders can also be located here.

The development of a rail connection is part of the development of the recycling area, this will lower the cost for transporting scrap metal to a steel plant.

Vehicle deregistration

Annual taxation based on vehicle ownership, or having a registered car, will encourage the last owner to have his old vehicle deregistered. In Mongolia, the car owner has to pay annual road tax and insurance for his vehicle, but many owners just do not pay. Only if stopped and checked during a police control a penalty is charged. An automatic notification IT program checking and penalizing automatically non-paying car owners will enforce deregistration of vehicles, both cars and motorcycles.

As soon as sufficient dismantlers are in operation, deregistration of vehicles should only be possible if a Certificate of Destruction (CoD) issued by an authorized dismantler is handed over. This will prevent local storage of bodies by unauthorized dismantlers.

10. PROJECT PROPOSAL TO IMPLEMENT ACTIONS

Project objectives

The objective is to set up a system in Mongolia to a sustainable processing of ELV's and to prohibit environmental pollution. Since hazardous waste cannot be exported, it all has to be treated in Mongolia.

At completion there will be a take-back network, dismantlers, shredder, waste collectors and treatment channels, shredder residue processing, scrap metal sales channels and are car owners aware of the recycling obligations.

Risks to be addressed

- Low value of ELV's.
- Last owner not bringing the vehicle to a take-back point or dismantler due to the low value or lack of willingness or awareness.
- Distance to take-back network too long.
- High transportation cost from take-back point to authorized dismantler.
- Insufficient number of authorized dismantlers.
- No collection of the disposed materials, tyres, oil and other fluids.
- No treatment of the disposed materials, tyres, oil and other fluids.
- No shredder company.
- High transportation cost for ELV from authorized dismantler to shredder.
- No sales channels for scrap metal.
- No possibilities for appropriate incineration of shredder waste.

Action plan

To prevent only writing opportunity plans, action is needed to get started. One simultaneous approach for total Mongolia is not realistic. Starting in Ulaanbaatar creates more chances for success, it is estimated that at least 75% of the vehicle park drives in this area. A further roll out should be developed after a successful start-up.

Recommended steps to set up a sustainable ELV recycling system

1. Create a temporarily ELV recycling fund through an additional recycling fee on vehicle imports and ensure sufficient payments into the ELV fund. As soon as a mature sustainable ELV system has been achieved, the value of the ELV might be sufficient to cover the recycling cost and the need for an ELV recycling fund should be reconsidered.
2. Establish "Vehicle Recycling Mongolia" as a Public Private Partnership (PPP) to execute Extended Importer Responsibility (EIR), funded from the ELV recycling fund.
3. Set up ELV rules and standards by Vehicle Recycling Mongolia and the Government.
4. Design an IT system automatically checking and penalizing non-payers of the annual vehicle tax and insurance.
5. Appoint authorized dismantlers by Vehicle Recycling Mongolia.
6. Create a showcase by providing the first authorized dismantlers with appropriate tooling and fluid tanks funded from the ELV recycling fund.
7. Create a system to have ELV's deregistered only after proof of destruction from an authorized dismantler.
8. Continue and intensify the support of the subsidiaries of GU Corporation for setting up the planned tyre recycling plant, extending the capacity of the waste oil recycling plant and collecting & treatment channels for oil, other fluids and tyres.
9. Build a shredder installation financed from the ELV recycling fund and governmental loan or set up a complete and detailed business case to find investors in a shredder.
10. Support the battery recycler to expand his activities and plant facilities.
11. Start negotiations with the appropriate organisation in Japan to have the \$100 recycling fee paid in Japan transferred into the ELV recycling fund, for vehicles exported to Mongolia.

Preferred approach for building a shredder installation is financing the project from the ELV fund. It would speed up the process since not all data for the business plan will be easily obtained or are just not available. Especially the annual ELV and e-waste volumes are probably not available and can only be estimated. This does not take away the need for a shredder.

As soon as the shredder process has become breakeven and start-up losses have been recovered, it should be sold to a private company.

Alternative is setting up a complete business case to get external financing involved. The Golomt Bank has indicated interest in being a partner.

Business case components to take into account for investment in a shredder installation

1. Annual volume of ELV's and end of life motorbikes
2. Annual volume e-waste
3. Supply channels
4. Sales channels
5. Location
6. Infrastructure
7. Machinery cost
8. Concrete foundation
9. Building and offices
10. Annual maintenance cost
11. Energy cost
12. Transportation cost
13. Labour cost
14. Shredder residue disposal channels (cement kiln)
15. Shredder residue disposal cost
16. Partners

11 REFERENCES

1. <http://www.autotrainingcentre.com>
2. ARN publications: Sustainability reports, Layman's report, Magazine 95
3. Wikipedia
4. <http://ubpost.mongolnews.mn/?p=6939>
5. Environmental Impacts of Road Vehicles. Past, Present and Future Volume 44, Edited by R.E. Hester and R.M. Harrison
6. Bazarragchaa Ichinnorov, Khan-Uul district, Ulaanbaatar
7. Page Report on industrial waste in Mongolia
8. Status of ELV recycling in Mongolia, presentation 6th Asian Automotive Environment Forum, Seoul 2013
9. Meetings at Ministry of Environment and Tourism
10. Meeting at Ministry of Auto Transportation Policy implementation
11. Meetings with GU Corporation
12. Several discussions with local entrepreneurs

12. ATTACHMENTS

Elements for ELV dismantler standards

Below is an overview of elements to be included in ELV dismantler standards which should be adapted to the national situation. It is advised to keep the standards simple and easy to explain.

1. Bookkeeping of ELV incoming and outgoing waste streams
2. Personal Protective Equipment
3. Instructed personnel
4. Proper tooling for depollution
5. Firefighting equipment
6. Statement of impervious floor where ELV's are drained
7. Dismantling of fluids
8. Dismantling of tyres
9. Airbag and belt tensioner detonation
10. Oil/water/sludge separator
11. Tanks for storing waste fluids
12. Dedicated storage of waste tyres and maximum allowed number
13. Valid contract with waste collectors
14. Deliver waste only to an authorized collector
15. Deliver bodies only to an authorized shredder or trader
16. Maximum number of ELV and bodies on the site (before and after treatment)
17. ELV's must be depolluted within 10 days after arrival
18. Provide disposer of ELV with Certificate of Destruction
19. Take back a ELV free of cost for the last owner
20. Dismantling certificate (after fulfilling the standards)