“Policy Measures and Incentives for Green Recycling of Lead in India”

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Summary

Globally, recycled or secondary lead is an important source of lead, which offers both a solution and challenge to the health hazards posed by this mineral. Lead recycling is carried out through a Deposit Refund System (DRS) in the market for batteries (branded and generic) which forms a part of a well defined 'extended producer responsibility' (EPR). EPR makes the original producer and seller of a product responsible for its end-of-life (EOL) environmental impacts. A DRS has existed in the Indian battery markets for a long time. In 2001 the Indian Government put in place a set of rules called the 'The Batteries (Management and Handling) Rules, 2001 to regulate the recycled lead market. Under these Rules, retailers are required to sell the used lead acid batteries (ULABs) "bought back" only to recyclers registered with the authorities and the recyclers in turn are required to use technologies that do not have a harmful impact on the environment. Manufacturers and importers are also required to buy recycled lead from registered recyclers.

A study conducted by the author entitled "Is the Deposit Refund System for Lead Batteries in Delhi and the National Capital Region Effective" in 2012 finds that the BMHR has failed to deliver the desired results. Currently, the bulk of ULABs generated in India is being recycled by the informal sector as retailers get a higher profit from that sector. The goal of this study is to further analyze the different policy options (instruments) suggested in the previous study in order to restrict (or completely do away with) the activities of informal lead smelters and recommend changes and policy options to strengthen and enhance the effectiveness of the existing EPR based DRS for recycling of ULABs in India.

The present study involves a comprehensive review of different variants of EPR based policies practiced in different parts of the world for safe recycling of hazardous waste like Waste Electronic and Electrical Equipment (WEEE), ULABs, tyres, used oil, cans, packaging material etc. This is followed by an analysis of the views put forward by experts from this area, government officials representing the regulator and industry representatives during our interaction. These inputs and findings of the previous study have been used to develop and analyze four different policy scenarios – (i) Base case scenario or the existing battery recycling (formal and informal) in India, (ii) Scenario with separate collection agency and informal collection system, (iii) Scenario with separate collection agency, informal collection

and smelting and (iv) imposition of green tax. The outcome of this analysis has been used to make policy recommendations.

Section 4 provides a comparative analysis of the different variants of EPR based policies for recycling of hazardous waste practiced in developed countries, developing countries without informal recycling and developing countries with informal recycling. EPR based recycling of different categories of waste has been very successful in developed countries followed by some of the developing countries without informal recycling like Taiwan and South Africa Almost no success has been observed in developing countries like India which have informal recycling. Upstream management with effective regulatory frameworks; proper guidelines for the manufacturers and other stakeholders; imposing only financial responsibility on manufacturers while outsourcing the physical responsibility of recycling to separate collection agencies have been the key factors for the success of the programme in developed countries and developing countries without informal recycling.

The four scenarios and the major gains and losses to major stakeholders involved in recycling of ULABs in India have been analyzed in section 6. Scenario I or the base case scenario does not involve any role of a separate agency for collecting ULABs. Under this scenario, manufacturers have both financial and physical responsibilities of collecting and ensuring green recycling of ULABs. Retailers serve as the interface between formal and informal recycling by choosing to sell the ULABs to the itinerant collectors or 'kabadiwalas' due to better incentive. The kabadiwalas then sell these batteries to informal smelters. The informal smelters sell the recycled lead to local battery manufacturers, assemblers and reconditioners. The role of manufacturers in scenario IV is similar to scenario I, except that they are required to pay a 'green tax' on each battery produced. The tax is refunded when the UALBs have been disposed/ recycled in a clean manner. The refund also compensates manufacturers for any additional expenses incurred in the process of collection. This arrangement would enhance the collection of ULABs from retailers leaving little or no scope for informal recycling.

Scenario – II and III have provision for the setting up of separate collection agencies. Manufacturers have only a financial responsibility of paying a recycling fee to the government recycling funds, used to fund (subsidize) these collection agencies. These separate agencies are responsible for the collection of ULABs from the retailers and scrap dealers (informal collection system). In scenario – III, a portion of the subsidy received by

these agencies is used for upgradation and pollution control in the informal smelting units. In both these scenarios, retailers sell the ULABs collected from the consumers either to the itinerant collectors or '*kabadiwalas'* or to the collection agency. In scenario – III informal smelters which are upgraded and equipped with pollution control devices using the fund received from and monitored by the separate agencies are also part of the scheme. They can sell the recycled lead to local battery manufacturers, assemblers and reconditioners and manufacturers as well. Consumers in all the four scenarios return the ULABs to the retailers and avail the discount.

In scenario – I, the retailers earn a small profit by selling ULABs to informal recyclers and gain more from avoiding the storage cost incurred due to very low frequency of collection visits by the manufacturer's representatives. Higher frequency of collection visits by itinerant collectors or 'kabadiwalas' in scenario – II and III and by the manufacturer's representative in scenario – IV helps them avoid the storage cost. In scenario – II, III and IV registered smelters benefit as enhanced collection provides more raw materials enabling them to increase their capacity utilization. Further, they also benefit from the fiscal incentives -lower taxes, permission to buy the ULABs both from the bulk consumers and the collection agencies and relaxed terms and conditions for importing ULABs in scenario – III. Manufacturers have increased supply of secondary lead and fulfil their obligation of green recycling in scenario – II, III and IV. They are spared from the physical responsibility of collecting ULABs in scenario – II and III. In the informal sector, itinerant collectors or '*kabadiwalas'* continue to remain in their usual business in scenario I, II and III. The informal smelters continue to operate only in scenario – III. Registered smelters and the manufacturers are the major losers in scenario – I, as low availability of raw material for the formal recycling results in low capacity utilization and non-compliance.

Based on the study the following recommendation has been made –

(i) Setting up of separate collection agency - Introduction of separate collection agency in scenario II and III into the existing recycling system or the base case scenario makes a significant improvement with almost all the major stakeholders benefiting from the system. The specific role assigned to the separate agency as outlined in scenario – II and III, ranging from collection of ULABs to ensuring upgradation and pollution control in informal smelters will have a significant effect on the entire recycling process. Both the upstream and the downstream stakeholders will benefit from the system. The formal sector benefits by an

increased supply of battery scrap while the collection chain of the informal sector still continue to be in their usual business.

(ii) Green Tax - A green tax could be imposed on each battery produced which could be refunded when the manufacturer shows that the battery has been disposed/recycled in a clean manner. In the event of non-compliance the tax collected could be used to subsidize the adoption of clean technology in the informal sector.

(iii) Strengthening the Organized smelters - The capacity utilization of organized smelters is low because of a limited supply of battery scrap. Setting up of the collection agency as mentioned in scenario – II and III and provision of some fiscal incentives like lower taxes, permission to buy the ULABs both from the bulk consumers and the collection agencies and relaxed terms and conditions for importing ULABs is recommended.

(iv) Compliance Monitoring – Declaring all aspects of BMHR (2001) compliance in their balance sheet/annual report to be mandatory for all the manufacturers. Continued failure of payment of recycling fees and submission of false or inaccurate reporting of battery production by the manufacturers should be referred to the courts for legal action. If the collection agencies and the registered smelters fail to submit the audited report of all their transactions, their registration should be cancelled with immediate effect and they should barred from re-registration for the next five years.

CONTENT

List of Tables

List of Figures

1. **Introduction--Research Problem**.

In 2001, the Ministry of Environment and Forests of the Government of India issued a notification called the 'The Batteries (Management and Handling) Rules, 2001,' applicable to every manufacturer, importer, re-conditioner, assembler, dealer, recycler, auctioneer, consumer, and bulk consumer involved in the manufacture, processing, sale purchase and use of Lead acid batteries. The retailers are now required by law to sell the used batteries "bought back" to only recyclers registered with the authorities and the recyclers in turn are required to use technologies that do not have a harmful impact on the environment. The legal framework even requires manufacturers and importers of batteries to be involved in the buy-back system either directly or indirectly. They are also required to buy recycled lead from registered recyclers.

This legal framework initiated "extended producer responsibility" in this industry by requiring manufacturers of batteries to be involved in the buy-back system. One of the intended results of the Rules was to curtail the activities of informal sector lead smelters whose crude methods of recycling lead hurt the environment and health of their workers and people in neighbouring areas. Lead is one of the most toxic metals in the world and has adverse impacts on the health of children and adults. This leads to lower productivity and human capital formation and in the long run could affect economic growth.

A study conducted by the author entitled "Is the Deposit Refund System for Lead Batteries in Delhi and the National Capital Region Effective (2012)[1]," (funded by the South Asian Network for Development and Environmental Economics) highlights the importance of the role and incentives of different stakeholders in the lead recycling industry in the functioning of the 'deposit refund system' and the success of 'extended producer responsibility' in the post BMHR era.

The results indicate that the deposit-refund system is very well established in this industry and ninety percent of the consumers surveyed do recycle lead-acid batteries by selling them to battery retailers irrespective of the price offered. However, the BMHR have not had the desired impact on the structure of the battery recycling industry as the informal sector continues to operate. The study of battery retailers indicates that a large number of used batteries are recycled by this sector because retailers prefer to sell the batteries to scrap dealers who in turn sell them to informal sector smelters. The higher frequency of collection visits by scrap dealers (indicating significant storage costs) and the higher price paid by them play an important role in this decision.

Using a case study of Chloride Metals Limited, the study also finds that depending on the scale of operation, collecting used batteries from retailers and operating smelting units can be economically viable for a battery manufacturer wanting to comply. The cost of complying with the BMHR is very high for the registered lead smelters. They are unable to operate at full capacity because of a limited supply of battery scrap.

The study suggests different policy options/instruments that can complement the DRS and provide correct incentives to stakeholders and ensure more environment friendly recycling of lead acid batteries. The current legal instrument does not penalize non-compliance. One policy option that might improve the recycling of lead within the formal sector is a green tax and linked subsidy on each battery produced in the organized sector. A large enough tax per battery manufactured along with an equivalent subsidy if the manufacturer shows that the battery was bought back (and properly disposed), could provide the necessary incentives for organized smelting. Other policy options suggested are allowing the organized sector to buy

[1] A revised version was subsequently accepted for publication in Environment and Development Economics (2014).

from scrap dealers and providing assistance to unorganized smelters to ensure green recycling and disposal.

Study Goal and objective

The goal of this study is to further analyze the different policy options (instruments) suggested in the previous study in order to restrict (or completely do away with) the activities of informal sector lead smelters whose crude methods of recycling lead hurt the environment and health of their workers and people in the neighboring areas.

2. Methodology

The study was carried out in two phases. The first phase involved a comprehensive review of variants of EPR based policies practiced in different parts of the world to deal with issue of safe recycling of hazardous waste like Waste Electronic and Electrical Equipment (WEEE), ULABs, tyres, used oil, cans, packaging material etc. The second phase involved interviews with key informants from different categories of stakeholders in this industry. These included experts from this area, government officials representing the regulator and industry representatives. Information acquired from both the phases was then used to recommend suitable changes in the already existing EPR based BMHR rules for recycling of ULABs in India.

3. Literature Review

About 80% of the lead produced worldwide is used in the manufacture of automotive lead acid batteries (Kreusch et. al., 2007). India is one of the fastest growing markets for passenger cars and the world's second largest manufacturer of two wheelers. It holds the distinction of being the largest manufacturer of motorcycles and the fifth largest manufacturer of commercial vehicles. Thus, the demand and use of lead in India is expected to significantly expand in the coming years. The industry manufacturing lead-acid batteries (automotive as well as other) in India is currently growing at a rate of over 20% per annum (EIL, 2009), and is heavily dependent on lead, which constitutes 50 percent of the operational cost of producing a battery (Das, 2009).

Lead acid batteries have a life of three to four years. This contributes to an almost un-noticed but serious environmental problem of hazardous waste.[2]Lead is a highly toxic metal and is considered one of the 17 most dangerous chemicals in terms of the threat it poses to human beings and the environment by the US Environmental Protection Agency (Wu et al., 2004). Lead can cause behavioral problems and learning disabilities and can be fatal to children who inhale or ingest it. Lead poisoning can lead to impaired physical growth, kidney damage, retardation, and in extreme cases even death. Birth defects like cardiovascular defects, oral clefts and musculoskeletal anomalies diagnosed in newborns are also associated with lead exposure (Vinceti et al. 2001). Furthermore, lead can also be toxic to plants, diminishing their productivity or biomass, and eliminating some species (Singh, et al., 1997; Xiong, 1997; Patra et al., 2004). Thus if left unchecked, lead pollution can have an adverse impact on productivity, human capital formation and economic growth in the long run.

Globally, recycled lead is an important source of lead, which offers both a solution and challenges to the health hazards posed by this mineral. Demand for lead is met from both primary and secondary sources. Primary sources constitute lead ores extracted from mines, whereas secondary sources of lead are smelters who recycle lead from lead scrap. The scrap mainly comprises of used lead-acid batteries, old lead pipes and cables. Used lead acid batteries (all types) with an average 10.5 kg of lead (Smith, 1999) serve as a source of raw material required for battery manufacturing. High rates of recycling are achieved in the countries where there is legislation governing the collection and recycling of lead-acid batteries. In poorer economies such as Egypt and India, very high rates of recycling are found but not reported because a large quantity of lead is recycled informally (Roberts, 2003). The informal sector in lead recycling can be extremely hazardous, particularly for workers.

Lead recycling is often supported through a well-functioning Deposit Refund System (DRS) in the market for batteries (branded and generic). In this system, people can get a discount on the purchase of a new battery if they return the used one to the retailer. Peter Bohm (1981) describes this as an arrangement between consumers and producers where a refund is provided even without taking a deposit. While a DRS has existed in the Indian battery markets for a long

[2] Lead acid batteries are classified as a hazardous waste under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.

time, in 2001 the Indian Government put in place a set of rules to regulate the recycled lead market. These rules stipulate where and how lead is supposed to be recycled and have supported the development of a market for recycled lead through a DRS for batteries.

While small-scale industries are very valuable for sustainable development, they can create problems when they generate high levels of pollution (Dasgupta et al., 1998). This is the case with lead acid batteries in India, which are recycled mainly by small scale smelting units operating in the organized as well as unorganized sectors.

The lead acid battery recycling industry in India lacked any kind of regulation till 2001. In the absence of proper smelting facilities and legislation, a large number of backyard smelting units and recyclers operated in India (and some still continue to operate). These backyard smelters recover lead from batteries in a crude manner, causing lead pollution in surrounding areas and affecting the health of the workers. Rao et al. (2007), estimate that nearly 11.35 kilograms of lead are released to the environment from the production of 1000 batteries. Recycling of battery scrap can cause environmental problems through the emission of dust containing lead particulates and sulphur oxides (Valdez, 1997).

In battery manufacturing plants, lead exposure to workers is a major occupational hazard (Yamin, 2007). Poor hygiene, inappropriate protection and lack of awareness increase the risk of lead poisoning. Most workers are ignorant of the ill effects of lead and do not take precautions such as wearing masks, gloves and safety glasses while handling lead. They also indulge in practices like eating, smoking and sleeping in the same premises, resulting in accumulation of dangerously high blood lead levels (Herman et al. 2007). In India, Rao et al. (2007), for instance, found that the average blood lead levels of battery workers were significantly higher than those of control groups. Hsiao et al. (2001), in another study in Taiwan, found that long-term exposure to lead among lead battery factory workers resulted in high levels of lead in their bones even after devices to reduce exposure were installed. The occupational hazards resulting from lead battery recycling in the un-organized sector was a motivating factor for India to formulate stronger regulations.

4. EPR based Deposit Refund System (DRS) as a policy tool for recycling waste – Evidence from different countries

The concept of 'extended producer responsibility' (EPR) has become the most important environmental policy to deal with recycling of wastes in many countries. EPR may be in practice in slightly different versions in different countries, but the core principle of any EPR policy remains the same. EPR makes the original producer and seller of that product responsible for a product's end-of-life (EOL) environmental impacts. OECD defines EPR as "an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle" (OECD, 2003). It calls for the policy to provide incentives to the upstream producers to incorporate environmental consideration in product design. Different policy instruments which come under the EPR have been put to practice both in developed as well as in developing countries with varying degrees of success.

Some of the common instruments operational under EPR include '*product take-back mandate and recycling rate targets*' which makes it mandatory for the manufacturers and/or retailers to take back EOL products and sets specific recycling targets, '*voluntary product take-back mandate and recycling rate targets*' require a purely voluntary approach for the take back with no penalties for not meeting the targets; '*mandatory take-back and targets with a tradable recycling scheme*' which in addition to mandating take-back and setting recycling targets allows trading of credits among themselves to meet the required targets; '*advanced recycling fee (ARF)*' which imposes tax on the sale of the product to cover the cost of recycling EOL products and '*ARF combined with recycling subsidy*' which uses the revenue generated from ARF to subsidize the recycling process. The most widely used policy instrument under EPR is system which combines tax on the product consumption with rebate or refund when the EOL product is returned for recycling or environment friendly disposal is known as '*deposit refund system (DRS)*' (Walls 2006; 2011).

The objective of this review is to compare and analyse these policy instruments which focus on DRS and their level of success across the globe. This review is undertaken under three sub-sections; a) DRS in developed countries, b) DRS in developing countries without involvement of informal sector and c) DRS in developing countries with active informal sector involved in recycling.

Table 1 presents a comparison of the EPR system in the developed countries, developing countries without informal recycling and developing countries with informal recycling. (Refer to Appendix - I for further details.)

Table 1 **Comparative status of EPR in the three categories of countries selected for this study - Developed, Developing and Developing with informal recycling**

Aspects of the EPR System	Developed Countries	Developing Countries without informal recycling	Developing Countries with informal recycling
Countries with EPR system	USA, Canada, UK, Netherlands, Japan	Taiwan, South Korea, Brazil, Thailand, South Africa	China, Malaysia, Philippines, Vietnam, Indonesia, India, Argentina
Target Product or Waste	Glass Bottles, tyres, ULABs, Used oil, WEEE, Packaging Waste	PET bottles, WEEE, Tyres, Glass bottles, Food and Beverage can	WEEE, ULABs
Regulatory Framework based on EPR principle	USA - US bottle bill, California Oil Recycling Enhancement Act, The Electronic Waste Recycling Act of 2003 Canada - Western Canada Used Oil Program, Netherlands - The Management of White and Brown Goods Decree, 1998 UK- Producer Responsibility Obligations (Packaging Waste) Regulations in 1997 and the Packaging (Essential Requirements) Regulations in 1998, Japan - Law for the promotion of Effective Utilization of Resources (LPUR) and Law for the Recycling of Specified Kinds of Home Appliances (LRHA)	Taiwan - Waste Disposal Act and Recycling Fund Management Committee (RFMC), South Korea - Producer Deposit Refund (PDR) system, 1992 and Producer Recycling (PR) system in 2003 Brazil – Draft Solid Waste Bill with provisions of EPR (implemented as agreement) South Africa – EPR is mostly industry initiative without any role of legislations Thailand – Legislative frame work under consideration	China - Regulation on the Administration of the Recovery and Disposal of WEEE effective from 1st January, 2011, Malaysia, Philippines, Vietnam, Indonesia, Argentina - Drafted EPR based legislation for waste management or are in the process of doing so, India - E-waste (Management and Handling) rules 2011 came effective from 1st May, 2012 and Battery (Management and Handling) Rules, 2001 amended in 2010.
Financial Responsibility of the Manufacturers	USA - Manufacturers pay certain fee on the oil sold which is refunded to certified collectors Canada – Environment Handling Charge (EHC) paid by the manufacturers to collectors	Taiwan – Manufacturers pay recycling fees to government recycling funds or the Recycling Fund Management Committee (RFMC). South Korea - Ministry of Environment (MoE) announces the item specific rates and recycling target based on which	China - regulation has set up a special fund for subsidizing formal e-waste collection, role of Manufacturer in contributing to the fund is not clear yet. Argentina – the draft Bill requires individual

	Netherlands – Manufacturers pay to the separate producer responsibility organizations (PRO) for collection and recycling of their product as well as orphaned product based on their market share UK- Manufacturers join the 'compliance scheme' who fulfil all the obligations on their behalf for a definite fee	manufacturers pay to the fee to the PRO and fulfil their obligation. Thailand – Manufacturers pay fee set by the Ministry of Finance to the separate account "Product fee account" for the purpose of meeting the direct expenses of WEEE management. South Africa – Mostly the manufacturers provide funding to the PRO for recycling.	financial responsibility for the management of waste from their products. India – For e-waste manufacturers required to finance and organize a system to meet the costs involved in complying with EPR,
Physical Responsibility of the Manufacturers	Most of the physical responsibility of recycling is outsourced and passed on to the downstream stakeholders in the chain	Taiwan, South Korea and Thailand and South Africa - physical responsibility outsourced and passed on to the downstream stakeholders . Brazil – Producers responsible for collecting, transporting and treating the material while infrastructure of drop-off centres provided by local governments.	China – Manufacturers have their own collection centres and are responsible for taking the waste to the ATFs. India – For e-waste it is outsourced to the authorized collection centres. For ULABs manufacturers themselves collect the ULABs and take it to the registered recyclers.
Responsibility Separate Collection centre	Prominent role of separate body for collection transportation and recycling. Mainly in the form of producer responsibility organizations (PRO) or the local municipalities	Separate body for collection transportation and recycling plays significant role. Mainly in the form of producer responsibility organizations (PRO), the local municipalities or local governments.	China – No separate collection centre and any guidelines regarding it is unclear. Mostly collected by the informal collectors. Malaysia, Philippines, Vietnam, Indonesia, Argentina – Informal collection India – For e-waste registered society or a designated agency or a company or an association registered with the SPCB act as authorized collection centre. For ULABs there is no separate collection centre.
Responsibility Retailers and consumers	Both Retailers and consumers play a significant role. Consumers are charged with 'up front fee' which is used for recycling. They also participate in the downstream DRS	Both retailers and consumers participate in the downstream DRS.	Consumers and retailers participate in downstream DRS. But lack of awareness and better price offer for their EoL products influences their decision to channelize the waste to the informal

			sector
Role of Informal Recycling	No informal recycling	No informal recycling	Informal recycling prevalent– poses two major challenge to success of EPR (i) Unknown producers leading to conditions of 'orphaned product and (ii) Low cost due to non-compliance give and edge to informal recyclers in receiving the waste. Formal recyclers have to face severe supply problem.
Success of the EPR Mechanism	Very high	High in Taiwan and South Africa, Moderate in South Korea and low in Brazil	Very low or almost no success.

Upstream Downstream

Success of the EPR based recycling of different categories of waste has been very high in developed countries followed by some of the developing countries without informal recycling like Taiwan and South Africa. Almost no success has been observed in developing countries like India which have informal recycling. The main factors that drive the success of EPR are upstream management in the developed countries like having effective regulatory frameworks highlighting the role of different stake holders and proper guidelines for the manufacturers. In most of the successful cases the role of manufacturers is restricted to carrying out the financial responsibility and outsourcing the collection and recycling by paying the required fee to the responsible entities. The downstream stake holders also have a significant role to play in the success of EPR as is evident from the role of producer responsibility organizations (PRO) responsible for carrying out the collection, transportation and recycling on behalf of the producers. Retailers and consumers also play a significant role in absence of informal recycling. It is only in the presence of informal recyclers that they act as an interface between the formal and informal sectors.

5. Current EPR-DRS for ULABs in India

5.1 BMHR, 2001 and Amendment, 2010

Ministry of Environment and Forest (MoEF) implemented a specific rule in 2001 to deal with the issues of EOL management of used lead acid batteries (ULABs) known as the Batteries (Management and Handling) Rules, 2001 (BMHR). BMHR is also based on the principle of EPR and it requires the manufacturers to collect (through the DRS or buy-back system) at least 90% of new batteries sold for organized smelting/recycling. It is mandatory for the retailers to sell the used batteries to registered smelters only. However like the other EPR schemes in developing countries, this also faces a major challenge from recycling in the informal sector. The Rules do not take into account the coexistence of the informal sector which is involved in recycling a major share of the ULABs. The major hindrance in the successful establishment of EPR in battery recycling is the poor collection system and the intense competition for ULABs from the informal sector due to low cost of recycling. The informal sector has an elaborate network of itinerant collectors (*kabadiwalas*) with greater penetration and high frequency of visits to the retailers. The high price offered and frequent visits for collection of the ULABs provide incentives to retailers to sell the ULABs to the informal sector.

Retailers serve as the main source of leakage of the ULABs from the formal to the informal system. In order to make the retailers or the dealers accountable for the recycling of ULABs by the registered smelters/recyclers, the MoEF notified the Batteries (Management and Handling) Amendment Rules, 2010.. The amendment requires manufacturers to sell the new batteries only to dealers registered with the SPCB/PCC. These registered dealers are now required to file returns every six months about the collection of the required number of ULABs failing which their registration is liable to be cancelled. The amendment has made dealers equally responsible along with manufacturers for non-compliance. In order to increase monitoring efficiency, SPCBs have been given regulatory powers. However, since there is a very large number of battery dealers/retailers, the downstream monitoring for the compliance is administratively very difficult as compared to the upstream monitoring of the few manufacturers.

5.2 Views on the present EPR-DRS for ULABs recycling in India

We sought the views of experts on the issue of BMHR in India through meetings and interviews. The objective was to get insights on the policy measures that could be implemented to eliminate informal recycling of ULABs in India and to find out ways to

strengthen the existing Batteries (Management and Handling) Rules, 2001 (BMHR). They were asked to express their views on having provisions in BMHR for penalizing the manufacturers for non-compliance, a tax-subsidy scheme to strengthen the EPR system and making both the manufacturers and retailers equally responsible for the failure of the rules rather than making the retailers more accountable as per the BMHR amendments, 2010. The issue of outsourcing of the lead smelting by registered smelters and manufacturers to informal sector due to low cost of smelting was also put forward for expert comments. Finally the feasibility of having a system of several dedicated collection agencies responsible for collecting ULABs as a solution for ensuring compliance by the different stakeholders in the recycling chain was also discussed.

6. Scenario Development

Based on the extensive review of cases of EPR-DRS across different countries, information collected from the key informant interviews and discussions and the findings of the earlier study by the author, four different recycling scenarios have been developed –

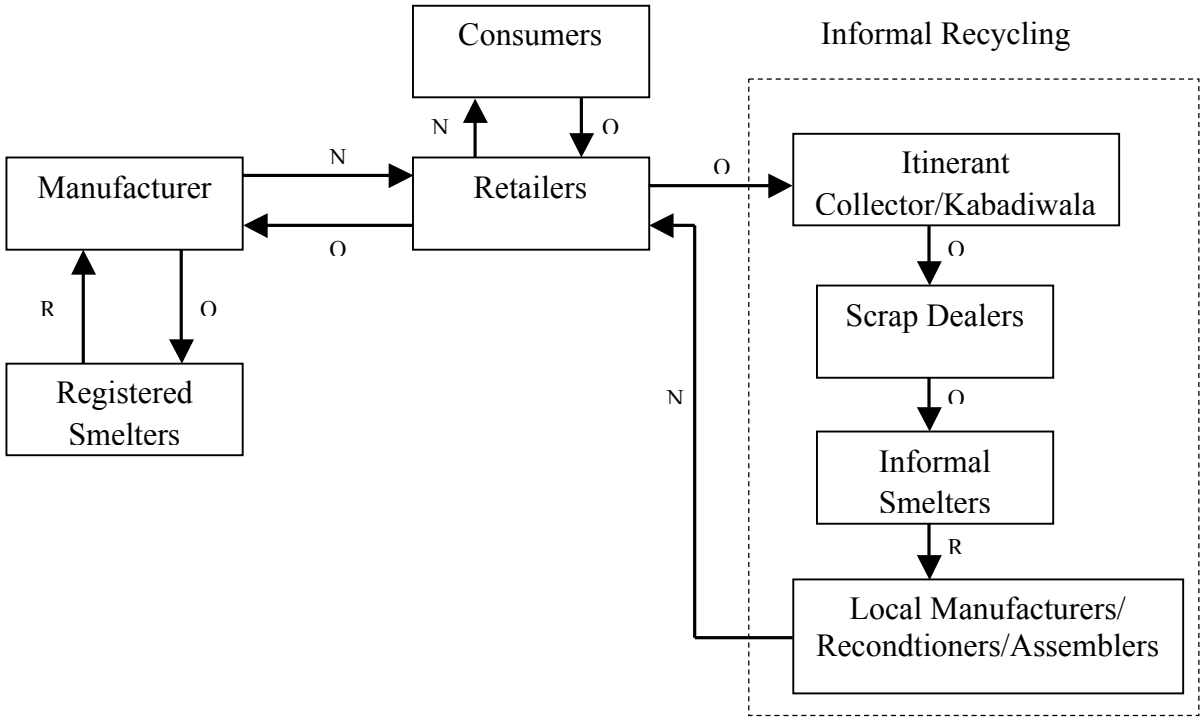
Scenario I: Base case scenario or the existing battery recycling (formal and informal) in India
Scenario II: Scenario with a separate collection agency and informal collection system
Scenario III: Scenario with a separate collection agency and informal collection and smelting
Scenario IV: Scenario involving imposition of green tax.

6.1 Scenario I - Base case scenario - Existing formal and informal battery recycling in India

Presently the DRS facilitates consumers of lead acid batteries with a discount on the purchase of new batteries on the return of used lead acid batteries to retailers (without any prior deposit made by them). The discount given by the retailers is determined by the market price of lead at the London Metal Exchange. Once consumers return used batteries to retailers, the recycling of these batteries is carried out through two modes – formal and informal. The formal mode complies with the Rules and involves retailers selling used batteries returned by the consumers to the manufacturers who have their own recycling unit or get them recycled from registered recyclers. The registered recyclers also recycle ULABs which they buy from bulk consumers such as the railways, the defense establishment and large industrial houses. All the recycled lead is sold to the manufacturers. The second pathway is of informal recycling which represents non-compliance with the Rules. This involves retailers selling the

used batteries to itinerant collectors or '*kabadiwalas'* who sell them to the scrap dealers, who then sell them further to the informal smelters or '*bhatti'*. These informal smelters then sell the recycled lead to the local battery manufacturers, assemblers and reconditioners. Figure 1 shows the existing EPR-DRS pathway for battery recycling in India which includes both formal and informal battery recycling.

Figure 1 Flow chart of the existing structure of formal and informal battery recycling in India



Note: 'N' – New Battery, 'O' – Old Battery, 'R' – Recycled Lead

Under this scenario the retailers act as the main leakage point from where the lead passes on for informal recycling. The study by Gupt (2014) finds that the retailers prefer to sell the ULABs to the itinerant collectors or '*kabadiwalas'* as the price offered by them is about Rs. 4 per battery higher than the price offered by the manufacturer's representative. This small price difference together with the taxes avoided and the storage problem (as manufacturer's representative visits less frequently than the '*kabadiwalas'*), influence the retailers decision to sell the ULABs to the informal recyclers. The total amount that prevents the retailers from compliance resulting in the sustenance of informal recycling works out to approximately Rs. 0.50 per kg or Rs. 500 per ton of recycled lead.[3]

The major drawback of this system is that here manufacturers are responsible for collecting the ULABs from the retailers and their collection system is very weak providing

[3] ULAB has about 8 kg of lead.

opportunities for the informal recyclers to take away the ULABs from the retailers even by offering a slightly higher price. It furthers requires the manufacturers to get the ULABs collected recycled by the registered smelters. The costs of installation and maintenance of pollution control equipment (other than bag filters), taxes on purchase of battery scrap (Table 4), and transportation costs incurred by these registered smelters increases the recycling cost significantly. This acts as a major deterrent for the formal recycling sector.

6.2 Scenario II: Separate collection agency involving informal collection system

Scenario II is a modified form of the base case scenario. It involves setting up of separate collection agencies at the municipal/ town/ city/ regional level to collect used batteries from retailers, consumers and scrap dealers. This agency could be a registered society, a designated agency, a company, an association or an NGO registered with the SPCB/PCC. By setting up of separate collection agencies, the physical responsibility of the battery manufacturer involving direct buy-back or recycling process would be shifted to the collection agencies. However, the manufacturers will have the financial responsibility of paying a recycling fee to the government recycling funds which will be used to fund (subsidize) these collection agencies. The recycling fee can be calculated based on the Taiwan model (as shown in Appendix II). Regular market survey would be required to update the parameters used in the calculation of the fee.

In Taiwan extended producer responsibility (EPR) systems under the Waste Disposal Act administered by the Environmental Protection Administration (EPA) require that manufacturers or importers of containers, PET bottles, batteries, cars, motorcycles (scooters), tyres, oil, televisions, refrigerators, air conditioners, washing machines, computers, and printers, pay recycling fees to government recycling funds. EPA then uses the recycling funds to subsidize collection and recycling. Under this arrangement, the deposit-refund scheme for the PET bottles which started in 1988 has been very effective. A target recycling rate of 50 per cent for the first two years (1989–90) and 60 per cent by the fourth year was set by the Taiwanese EPA. By the third year the recycling rate achieved was only 41 per cent, but by the fourth year (1992) it reached to almost 80 per cent (O'Connor, 1999). The success is attributed to the strong incentives which led to the setting up of a wide network of collection centres and development of a sizeable industry for recycling.

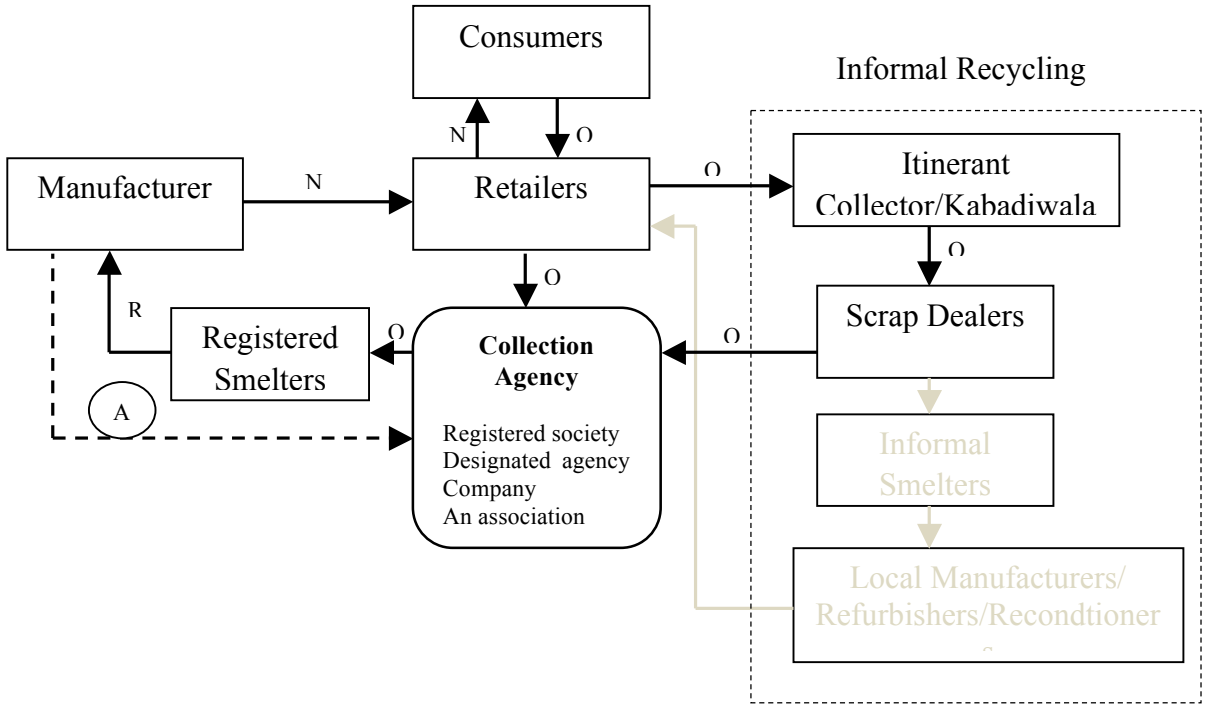
In case of WEEE, number of formal WEEE recyclers has increased significantly from zero formal recyclers in 1997 to 19 facilities at the end of 2011. The programme has been successful

in achieving a collection rate higher than 50 per cent consistently. This is at par with the developed countries like Japan and Korea and twice as high as that of USA. The volume of WEEE recycled has also been higher than 50 per cent consistently between 2006 and 2010 (EPA, 2012). Similar success of the upstream DRS has been observed in case of 'Western Canada Used Oil Program', undertaken in Canada to deal with improper disposal of used oil. In this industry-run programme, a fee imposed on sale and import of used oil is used to give incentives to the authorized collectors, transporters and recyclers for every litre of oil, containers and filters recycled or reused by them. The success of the programme is reflected in very high over all recovery rates which stood at around 75 per cent in 2004 across all provinces. In British Colombia the recovery rate of used oil, filters and containers increased from 72, 82 and 42 per cent respectively in 2004 to 80, 85 and 79 per cent respectively in 2012 (BCUOMA 2005, 2012). The success of these models has opened up options for countries like India to have similar arrangement for effective waste recycling.

Unlike Taiwan, in India the presence of the informal sector in this industry is very significant. A complete elimination of informal recycling would have both economic and social implications. Hence there is a need to integrate informal recycling with formal recycling in a way that is mutually beneficial. In this scenario the separate collecting agency will enhance its collection efficiency by integrating the collection portion of the informal recycling pathway comprising of the '*kabadiwalas*' and scrap dealers. Figure 2 is a flow chart for a separate collection agency integrating the informal collection system.

The informal collection system comprising of the itinerant collectors/'*Kabadiwalas*' and the scrap dealers already have an intense network and greater penetration in the market. The subsidy received by the agency would enable it to offer high prices for ULABs than the informal smelters. This would curb the flow of ULABs to the informal smelters. In addition, the retailers will now be left with the option of selling to the '*Kabadiwalas'* or to the collection agency. The high frequency of visits by these '*Kabadiwalas'* solves the storage problem faced by the retailers (which is one of the major causes of non-compliance in Scenario – I). This would direct the movement of ULABs to formal recycling using the already prevalent informal collection network.

Figure 2: Scenario– II Separate Collection Agency integrating informal collection



Note: 'N' – New Battery, 'O' – Old Battery, 'R' – Recycled Lead

→ Material Flow

- - ▶ Financial Flow

(A) Recycling fee paid to the government recycling funds used to fund the collection agency

In this scenario the formal sector benefits by an increased supply of battery scrap while the collection chain of the informal sector still continues to be in its usual business. The organized smelters (and registered reconditioners) have the option of buying ULABs from their local collecting agency enabling them to have sufficient raw material increasing their capacity utilization. The scenario completely eliminates the role of informal smelters in recycling. This would mean loss of jobs for those engaged in these informal smelters. For instance some 840 workers may lose their jobs in Delhi-NCR alone (Gupt, 2014).

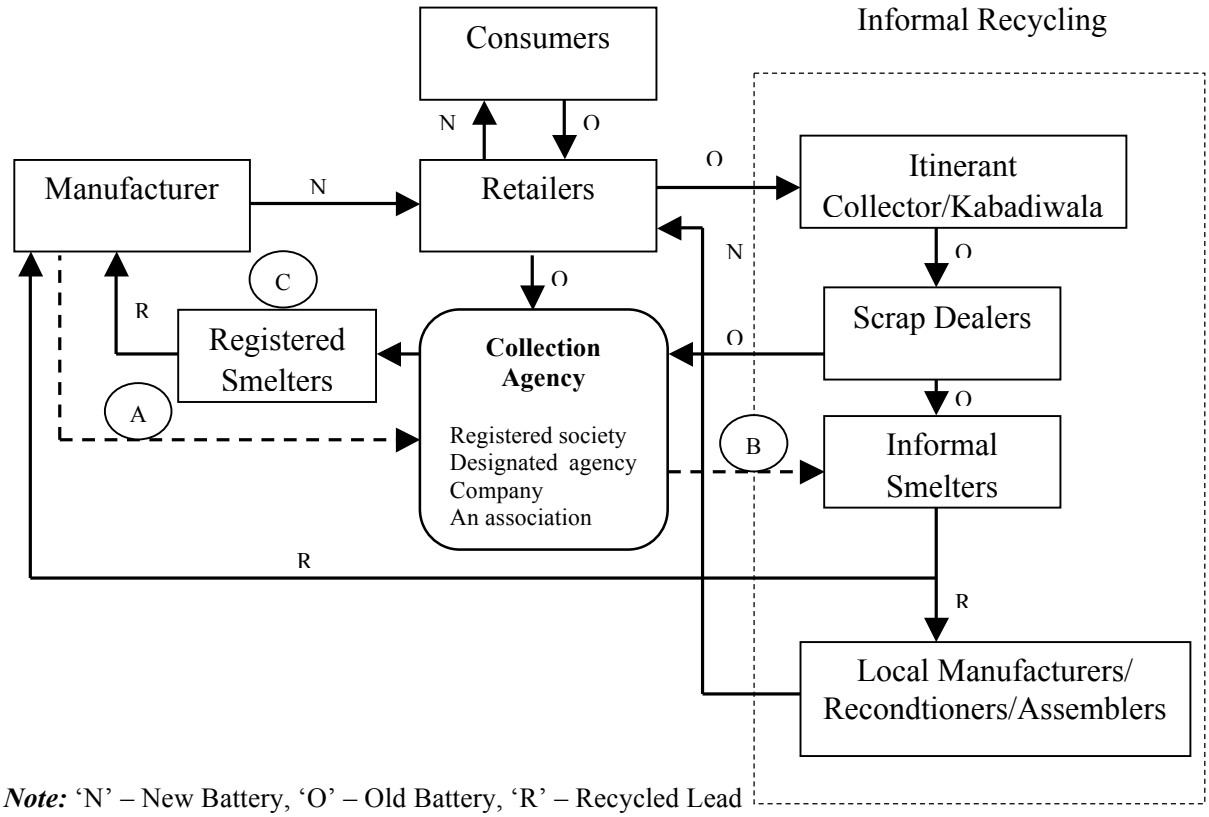
Unlike the base case scenario, there is a provision for penalty in case of non-compliance such as continued failure of payment of recycling fees and submission of false or inaccurate reporting of battery production. Such incidence could be referred to the courts for enforcement.

6.3 Scenario III: Separate collection agency involving informal collection and smelting

Scenario III is different from Scenario II in the sense that it involves the informal smelters. In this scenario, the battery manufacturers have the option to buy the recycled lead from the informal smelters also, provided the informal smelters have adopted the required pollution control measures. Some part of the fee collected from the manufacturers will be used for upgradation and pollution control in the informal smelting units through a government recycling fund. This will make the manufacturers responsible for pollution control in these informal smelters. The collection agencies will be subject to regular audits to be eligible for subsidies from the government recycling fund. The manufacturers would benefit from this arrangement, as now they would get the supply of recycled lead both from the registered as well as informal smelters. Opening up of the option for the manufacturers to get their raw material both from informal and formal smelters would enable them to get the recycled lead at a lower cost from these informal smelters. Figure 3 provides a flow chart of scenario-III for the proposed changes in the existing recycling system.

Under this scenario, the interests of the registered smelters are safeguarded by providing fiscal incentives like lower taxes, permission to buy the ULABs both from the bulk consumers and the collection agencies and relaxing the terms and conditions for importing ULABs. This scenario takes care of all the stakeholders of the base case scenario. Here both the informal collection system and the smelter continue to be in their business as usual. Accountability of the collection agency enforced through regular audits takes care of the environmental problems associated with the informal smelting. The investment required for pollution control in the informal smelters and necessary paper work is taken care of by the collection agencies. The scenario ensures enhanced collection and recycling rate with the existing system of recycling ULABs in India just by introducing a separate collection agency to the system. A wide network and efficient monitoring of these collection agencies is vital for the success of the scheme.

Figure 3: Scenario – III Separate Collection Agency integrating informal collection and smelting



Note: 'N' – New Battery, 'O' – Old Battery, 'R' – Recycled Lead

Material Flow

Financial Flow

A — Recycling fee paid to the government recycling funds used to fund the collection agency

B — Funding for the upgradation and pollution control

C — Incentive in the form of lower taxes, relaxation on restriction of sources for getting the domestic scrap and import of scrap.

Similar to scenario II, there is provision for penalty in case of non-compliance such as continued failure of payment of recycling fees and submission of false or inaccurate reporting of battery production. Such incidence could be subject to legal action.

6.4 Scenario IV: Scenario involving imposition of green tax.

This is similar to the base case scenario where the manufacturers are responsible for collecting the ULABs from the retailers. The manufacturer then ensures that the ULABs

collected are recycled by registered smelters only. In this scenario a green tax is imposed on each battery produced, which is refunded when the manufacturer shows that the battery has been disposed/recycled in a clean manner. In addition to the tax, the refund also includes an amount that covers any additional expense incurred in collecting the battery. This removes any incentive on the part of the manufacturer to under report battery production. The manufacturer could be charged a lump-sum amount based on past production levels to cover the additional amount refunded. In the event of a manufacturer not fulfilling his obligation of clean recycling of all batteries produced, the tax collected is used to subsidize the adoption of clean technology in the informal sector.

6.5 Comparison of the Scenarios

Table 2 provides a comparison of the four scenarios developed in this study:

Table 2 Role of different stakeholders under the 4 scenarios

Aspects of the EPR-DRS System in India	Scenario - I	Scenario - II	Scenario - III	Scenario - IV
Separate Collection Agency	Not Present	Present	Present	Not Present
Role of the Manufacturers	Collect the ULABs from retailers Recycle them in their own smelters or get it recycled from the registered recyclers	Pays a recycling fee to the government recycling funds. Fee used to fund (subsidize) these collection agencies.	Pays a recycling fee to the government recycling funds Fee used to fund (subsidize) these collection agencies Option to buy the recycled lead from the informal smelters (only from those having pollution control measures)	Collect the ULABs from retailers Recycle them in their own smelters or get it recycled from the registered recyclers Pay the 'green tax' on each battery produced. Tax refunded when the UALBs have been disposed/ recycled in a clean manner. Refund also to compensate additional expenses towards ULABs collection.
Role of the Separate Collection agency		Collect used batteries from retailers and scrap dealers (informal collection system) Subsidy received used to pay higher price to the scrap dealers.	Collect used batteries from retailers and scrap dealers (informal collection system) Subsidy received used to pay higher price to the scrap dealers. Portion of the subsidy used for upgradation and pollution control in the informal smelting units. Carry out all paper work of these informal smelters.	

Role of the Retailers	Formal Recycling - Sell the ULABs collected from the consumers to the manufacturer's representative. Informal Recycling - Sell the ULABs to the itinerant collectors or '*kabadiwalas'*.	Sell the ULABs collected from the consumers to the itinerant collectors or '*kabadiwalas'* Sell the ULABs collected from the consumers directly to the collection agency.	Sell the ULABs collected from the consumers to the itinerant collectors or '*kabadiwalas'* Sell the ULABs collected from the consumers directly to the collection agency.	Formal Recycling - Sell the ULABs collected from the consumers to the manufacturer's representative only.
Role of the Informal Recycling	Itinerant collectors or '*kabadiwalas'* sell the ULABs to the scrap dealer. Scrap dealer sell it to the informal smelters. Informal smelter sell the recycled lead to local battery manufacturers, assemblers and reconditioners	Only the informal collection system is a part of the scheme. Itinerant collectors or '*kabadiwalas'* collect the ULABs from retailers and sell to the collection agency through scrap dealers.	Both the informal collection system and the smelters are part of this scheme. Itinerant collectors or '*kabadiwalas'* collect the ULABs from retailers and sell to the collection agency through scrap dealers. Informal smelters sell recycled lead to local battery manufacturers, assemblers, reconditioners and Manufacturers	
Role of the consumers	Return the ULABs to the retailers and avail the discount.	Return the ULABs to the retailers and avail the discount.	Return the ULABs to the retailers and avail the discount.	Return the ULABs to the retailers and avail the discount.

Upstream Downstream

Table 3 Gain and loss under the 4 scenarios

	Scenario - I	Scenario - II	Scenario - III	Scenario - IV
Gain to the stakeholders				
Stakeholders	**Formal Recycling**			
Consumers	Gets the discount on returning the ULABs	Gets the discount on returning the ULABs	Gets the discount on returning the ULABs	Gets the discount on returning the ULABs
Retailers	Has profit margin of 0.9 % by selling it to the informal recyclers (Gupt, 2014).	Receives higher price for the ULABs from the collection agency than the '*kabadiwalas*' Only incentive – High frequency of visit by '*kabadiwalas*' reduces the storage cost significantly.	Receives higher price for the ULABs from the collection agency than the '*kabadiwalas*' Only incentive – High frequency of visit by '*kabadiwalas*' reduces the storage cost significantly.	Receives higher price for the ULABs from the Manufacturer's representative
Registered Smelters		Enhanced collection provides more raw materials enabling them to increase their capacity utilization.	Enhanced collection provides more raw materials enabling them to increase their capacity utilization. Fiscal incentives - lower taxes, permission to buy the ULABs both from the bulk consumers and the collection agencies and relaxed terms and conditions for importing ULABs.	Enhanced collection by the manufacturers provide more raw materials enabling them to increase their capacity utilization.
Manufacturers		Increased supply of secondary lead. No physical responsibility of collecting the ULABs	Increased supply of secondary lead. No physical responsibility of collecting the ULABs	Increased supply of secondary lead. Fulfils its obligation for green recycling by paying the fee.

		Fulfils its obligation for green recycling by paying the fee.	Fulfils its obligation for green recycling by paying the fee.	
	Informal Recycling			
Collection System (Itinerant collectors or '*kabadiwalas'* and Scrap dealers)	They do brisk business in the absence of or low frequency of visits by the Manufacturer's representative.	Continue to remain in their usual business and benefits from higher price received from collection agencies.	Continue to remain in their usual business and benefits from higher price received from collection agencies.	
Informal Smelters	No compliance cost and consistent supply of ULABs keep them in business.		Collection agency invests in pollution control and carries the paper work. Consistent supply of ULABs keeps them in business. Sell the ULABs to the manufacturers.	
Loss to the stake holders				
Stake holders	**Formal Recycling**			
Consumers	No Loss	No Loss	No Loss	No Loss
Retailers	No Loss	No Loss	No Loss	No Loss
Registered Smelters	Low availability of raw material results in low capacity utilization	No Loss	No Loss	No Loss
Manufacturers	**Lower recycling rate** **Non-compliance**	No Loss	No Loss	No Loss
	Informal Recycling			
Collection System (Itinerant collectors or '*kabadiwalas'* and Scrap dealers)	No Loss	No Loss	No Loss	Out of business
Informal Smelters	No Loss	Out of business – Job loss	No Loss	Out of business

7. Recommendations

Based on the analysis of the scenarios developed in the preceding section the following recommendations are made –

7.1 Separate Collection agency

In both scenario II and III, a separate collection agency plays a major role in the recycling of ULABs. The introduction of this agency into the existing recycling system or the base case scenario makes a significant improvement with almost all the major stakeholders benefiting from the system. Thus we recommend setting up of separate collection agencies to improve the current recycling system. The collection agency could be in the form of a registered society, a designated agency, a company, an association or an NGO registered with the SPCB/PCC. An adequate number of such agencies with wide collection and distribution networks should be allowed to operate as this would increase the reach of the formal recycling system of ULABs.

The separate collection agency would be responsible for collecting the used batteries from retailers and scrap dealers (informal collection system) and pass it on to the registered smelters. It will be accountable for all the transactions and undergo regular third party audit, the report of which should be submitted to the concerned SPCB/PCC on a regular basis. In case of scenario III which integrates the informal smelters with the formal recycling system, these agencies would have the additional responsibility of investing, monitoring and keeping account of all pollution control activities in these informal smelters. They will be responsible for all the paper works and provide the monitoring reports of pollution control in these units to the concerned SPCB/PCC on a regular basis. The recycling fee paid to the government recycling funds by the manufacturers will be used to fund (subsidize) these collection agencies. The calculation of the recycling fee (given in Appendix-I) would require regular market survey to update the parameters.

The major advantage of setting up of separate collection agencies is that both the upstream and the downstream stakeholders will benefit from the system. The formal sector benefits by an increased supply of battery scrap while the collection chain of the informal sector still continue to be in their usual business. Manufacturers will be left with just the financial responsibility of paying a recycling fee to the government recycling funds which will be used to fund (subsidize) these collection agencies. The organized smelters (and registered reconditioners) would have sufficient raw material increasing their capacity utilization.

Retailers would benefit from avoiding the storage cost due to low frequency of visit by the manufacturer's representative at present. Further, entrusting these agencies with the major responsibilities would make compliance monitoring administratively easier and effective for the regulators.

7.2 Green tax

A green tax could be imposed on each battery produced which could be refunded when the manufacturer shows that the battery has been disposed/recycled in a clean manner. In addition to the tax, the refund could also include an amount that covers any additional expense incurred in collecting the battery. This would remove any incentive on the part of the manufacturer to under report battery production. The manufacturer could be charged a lump-sum amount based on past production levels to cover additional amount refunded. In the event of a manufacturer not fulfilling his obligation of clean recycling of all batteries produced, the tax collected could be used to subsidize the adoption of clean technology in the informal sector.

7.3 Strengthening the Organized smelters

As of September 2010, 353 lead recyclers were registered with the CPCB. Of these only 24 have a capacity greater than 10,000 tons/year (the minimum size required for a similar recycler in China). These smelters get battery scrap from government auctions of bulk consumers like the railways and defense establishment and also from the import of lead scrap (under license from the Ministry of Environment and Forest (MoEF)). The capacity utilization of organized smelters is low because of a limited supply of battery scrap. Indian Bureau of Mines study (2011) shows that out of 134 units surveyed only 40% were operating and at an average capacity utilization of 50%. The installation and maintenance of pollution control equipment (other than bag filters) together with applicable taxes (as shown in the table below) and transportation costs[4] add to the cost of running the smelting units. This additional cost can be considered the compliance cost for the organized smelters (Gupt, 2014).

[4] According to an order of the Delhi High Court all registered smelters have to be located beyond a radius of 60km from Delhi. The terms of the auctions require the buyer to arrange for the transport of raw materials from the auction site to their units within the stipulated time.

Table 4: Illustrative Costs of setting up a smelting unit in the organized sector in NCR—an example for Mandir-Bhatti or Open Hearth furnace with a capacity of 5000 Mt/year

Costs	**Figures in Indian Rupees**
Cost of Land	3,000,000 (1500 sq. yard @Rs. 2000/sq. yard)
Infrastructure Cost	4,000,000 (7500 sq. ft @ Rs. 500/sq. ft.)
Equipment Cost	1,500,000 (furnace, pollution control device)
Fuel	2,400,000 per annum
Electricity	360,000 per annum
Maintenance	30,000 per annum
Revenue	
Revenue from Ash	4,800,000 per annum (200 Mt/month @Rs. 2 per kg)
Taxes on Sales	
Central Sales Tax	2% if selling outside the region
Excise Tax	10.3%
VAT	5% if selling within the same region
Taxes of Raw Materials	
Central Sales Tax	2% if buying from Government Organization and Private Company
Excise Tax	10.3% if buying from Private Company
Customs Duty	If importing

Source: Gupt , Yamini (2014)

Hence there is a need to incentivize organized smelters to increase the production of secondary lead in the organized sector (increase capacity utilization) and follow stricter pollution control norms. Some areas where stricter pollution control is required are:

- Smelters should have automatic battery breaking plants. This will ensure that the plants are of minimum size and that acid is not disposed off on the ground during battery breaking.

- Many of the small scale smelters do not operate the scrubber/bag filters to cut costs. Hence there is a need to work towards online stack emission monitoring at PCB's to ensure compliance on emission as is practiced in some countries.

- Proper Slag disposal continues to be a major compliance issue as it is being used for landfills and causes irreversible damage to water tables. Once there are regulations specifying technology for battery breaking/online stack emission monitoring, lot of

non complaint units will close down and it will be possible to monitor safe slag disposal for the complying units.

- Inventory of battery scrap should be immediately introduced through an online system so that it can be tracked. All filing of returns should go on line so that CPCB can monitor the data centrally.

Some of the suggested incentives for smelters are as follows:

- Some fiscal and other incentives could be given to the smelters. These could include lower taxes, (for instance on the purchase of battery scrap), green certification, and re-registration after a longer time periods (to reduce paper work and effort).
- Our discussions with the different stakeholders also revealed that some organized smelters outsource their smelting operations to the informal sector to reduce the cost of smelting.
- Easing of the eligibility criteria for the smelters to import lead scrap could solve the problem of under-capacity performance of the registered smelters. More import of lead scrap will drive down the price of this raw material and reduce the cost of finished product. This would prevent the registered smelters from outsourcing the lead smelting to the unorganized and polluting smelters.

The above mentioned incentives along with regular auditing of their energy consumption, raw material used and the output produced would curtail the outsourcing of lead smelting to the unorganized sector.

7.4 Compliance Monitoring

As per BMHR Amendment 2010, battery dealers are required to be registered with and file returns of the ULABs received to the respective state pollution control board. It is very difficult to monitor battery dealers because of their large number. Policy measures implemented upstream (for instance involving the top 10 manufacturers) are easier to implement and could result in greater compliance. The manufacturers can be made more accountable if they are mandatorily required to declare all aspects of BMHR (2001) compliance in their balance sheet/annual report.

In case of setting up of a separate collecting agency as recommended in this study based on scenario II and III, there should also be a provision for penalty in case the manufacturers fail to comply. For instance when there is a continued failure of payment of recycling fees and submission of false or inaccurate reporting of battery production. Such incidence could be referred to the courts for legal actions. If the collection agencies fail to submit the audited report of all the transaction that it makes (number of ULABs collected and sent to registered recyclers, subsidy received, investments and running cost of pollution control equipments in the informal smelters and transportation costs) and the pollution monitoring in informal units within the stipulated time (could be monthly or quarterly), their registration should be cancelled with immediate effect and barred from re-registration for the next five years.

The registered smelters would also need to submit an audited report of their transactions along with monitoring report of pollution control. The measures recommended in the preceding sub section to increase the supply of raw materials to these smelters like tax exemptions, easing of eligibility criteria to import lead scraps would be applicable for these units only in case they furnish the monitoring report of pollution control approved by the concerned SPCB/PCC to the respective departments. In case of non-compliance their registration should be cancelled with immediate effect and they could be barred from re-registration for the next five years

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Appendix I

Review of EPR-DRS cases in Developed, Developing and Developing countries with informal recycling

1 EPR - DRS in developed countries

1.1 EPR - DRS in Unites States of America (USA)

USA has a long history of successful DRS. Started initially in 1971 as the famous 'bottle bill' which required consumers to make a deposit on all beer and soft drink containers which was later refunded on return of containers for safe recycling. Currently ten states of USA have some kind of water bill. The system predominantly works through the distributors and retailers, with retailers serving as the middlemen. Retailers pay the deposit for each container to the distributor and in turn collect that deposit from the consumers on each purchase. On return of the container by the consumers, the retailer refunds the deposit to the consumers and reclaims that money from the distributor. A slightly different scheme is practised in the states of California and Hawaii. Here, the distributors pay the deposits received from consumers through retailers to the state government. Consumers have the option of returning containers to a variety of redemption centres and get the refund coming from state managed programmes. The system has registered a high success rate of recycling of over 70% in almost all the states.[5]

The concept of DRS has been put to practice in recycling of wastes other than bottles and cans like used lead acid batteries (ULABs), tyres, motor oil, various hazardous wastes, electronic wastes etc. The US has an effective DRS for recycling of ULABs in forty-four states. Retailers charge a fee on all batteries sold which is refunded if the consumers bring back ULABs within 30-45 days of purchase. Adoption of a DRS approach has led to increase in recycling of ULABs to 97 percent as compared to 86 percent without such system (BCI). A somewhat different DRS approach is used for the recycling of tyres. A different fee is charged from the consumers based on the type of the tyre. Unlike the DRS in bottles and ULABs, a system of upstream refund is practised. Revenue collected through the deposits is not refunded to the consumers; instead it is used to subsidize scrap tyre processors. This

[5] Details of the US Water bill can be accessed from -http://www.bottlebill.org/legislation/usa/allstates.htm

eliminates the transaction and administrative costs associated with collection and sorting of recyclables. Incentivizing processing rather than collection avoids cases where collection is made for recycling but no recycling takes place.

The upstream model of DRS has proved to be successful in recycling of used motor oil in California. The California Oil Recycling Enhancement Act requires manufacturers to pay a certain fee on the oil sold which is refunded to certified collectors. The consumers benefit by this system as they are given some incentives by the collectors. Recycling of electronic wastes is another field where the upstream DRS had shown significant success. In case of electronic waste, the take-back scheme failed to deliver with exception in the state of California. The Electronic Waste Recycling Act of 2003 required charging fees on the sale of television, computer monitor and laptop depending on the screen size. Revenues collected from the fees are used to provide incentives to the authorized collectors and reprocessors. The scheme has been now extended to cover a range of electronic wastes other than monitors.

1.2 EPR - DRS in Canada

Improper disposal of used oil is another major environmental concern which has been successfully addressed by an effective upstream DRS model in Canada, undertaken as 'Western Canada Used Oil Program.' Under this industry-run programme, sales and imports of used oil, oil containers and oil filters are subjected to a fee referred to as environmental handling charge (EHC). The fee thus collected is used to pay incentives referred to as 'return incentives' (RI) to the authorized collectors, transporters and recyclers for every litre of oil, containers and filters recycled or reused by them. The program running in each province is separate from the other. The amount of the fee to be charged is decided by the respective non-governmental organization operational in each province. They are also responsible for the collection of fee and disbursement of RI. The RI varies with location based on the transportation cost. Sometimes the RI is greater than EHC, as the sale of oil is much higher compared to the used oil generated; 35% is burned during use.

The program came into existence in the four western provinces of Canada – Alberta, British Columbia, Saskatchewan, and Manitoba between 1997 and 2003. The recovery rate in these provinces registered considerable increase every year after the implementation. The recovery rate across all the provinces was 75% in 2004, second to UK which registered the highest recovery with 76%.

Success of the programme was most distinct in British Colombia. Till 3003 British Colombia had the traditional take-back system in practice which required the retailers to collect used oil from consumers at no cost and make arrangements and payments to the waste management companies to collect from them and transport it back to the recyclers. The main problem with this system was the non-compliance as many retailers refused to take back the used oil due to high cost of take-back and waste management. The new upstream DRS model eliminated this problem of non-compliance to a great extent. The recovery rate of used oil, filters and container increased from 61%, 17% and 12% in 2002 under the old take-back system to 72%, 82% and 42% under the new system in 2004 and by 2012, the figures of the recovery rate reached to 80%, 85% and 79% respectively (BCUOMA 2005, 2012).

The programme has made it mandatory for the non-governmental organization acting as collectors in each province to file annual reports with balance sheets and other financial information. The information provided gives the actual cost of the Canadian programme and is very useful for the implementation and success of the programme. The estimated annual cost of removing the used oil in Alberta was around $16 million in 2012. Revenue collected as EHC was around $16 million and the expenditure including the RI was also around $16 million. Thus the total cost of removing the used oil legally amounts to $16 million. The environmental benefits from the prevention of illegal disposal of used oil further add to the benefits of the programme. The administrative cost has been low ever since the programme was started and it was just 3.93% of the total EHC collected in 2012(Annual Report 2012).

1.3 EPR - DRS in the Netherlands

The Management of White and Brown Goods Decree, passed in 1998 made the Netherlands the first country in Europe to introduce the EPR principle for a wide range of electronic and electrical equipment. The programme was started in 1999. Under this Decree it became mandatory for the retailers to take back old electronic and electrical goods in exchange for new ones and manufacturers to accept those products from retailers and arrange for transportation and recycling. The decrees also required municipalities to take products back free of charge. After negotiation with the industries the recovery and reuse targets which varied across products, ranging from a high of 75% for refrigerators down to 45% for small appliances were fixed. Recycling cost was to be covered by visible up-front fees, to be charged on products. Separate producer responsibility organizations (PRO) were engaged for

managing collection and recycling for the producers of household appliances, stereos, and televisions – called “white and brown goods” and computer equipment, called “grey goods”. After 2003, for the grey goods, the earlier system of fees charged based on the weight of the EOL products was replaced by a system where a third party organization was hired to obtain confidential sales data from member companies and issue invoices based on market share of sales. Most importantly, the costs associated with orphan products were then apportioned to members based on market share.

Retailers dealt with the storage and handling difficulties by offering discounts if the buyer did not return the EOL appliances. Thus 80% were being collected by municipalities which then forwarded it to the collection and sorting depots present across the country for drop-off services. The cost of operating these depots is shared by the PROs. Success of the programme is reflected by the sustained achievement of the EU target of 4 kg of Waste Electronic and Electrical Equipments (WEEE) per person per year since 2001. In 2005, new requirements based on the EU WEEE directives were embodied in the Dutch WEEE Management Regulations. New targets include 80% recovery rate and 75% recycling rate for home appliances, 75% recovery rate and 65% recycling rate for computer equipment and 70% recovery rate and 50% recycling rate for small home appliances and toys. The financing system also changed. Now the producers are responsible for equipment put on the market prior to August, 2005.

The Dutch system showed the benefits of having visible fees. The fee provides incentives to consumers to reduce consumption and thereby reduce waste, motivate producers to reduce product weight and material content if it varies with product weight and provide revenues to cover the costs of collection and recycling. A higher price for a product should lead to reductions in the quantity demanded regardless of whether the higher price results from a visible tax or an invisible one. Thus the fee in any form will help reduce the waste. Also, if the fee varied across products or brands, it could lead to differential purchasing decisions that could be beneficial for reducing waste.

1.4 EPR – Through Tradable Permits in United Kingdom

The U.K. Packaging Waste Program is primarily based on the concept of tradable recycling credits which provides incentives to the manufacturers for collection and recycling of waste and has potential for promoting 'design for environment' (DfE). Producer Responsibility Obligations (Packaging Waste) Regulations in 1997 and the Packaging (Essential Requirements) Regulations in 1998 (hereafter referred to as the "Regulations") require producers to recover and recycle a specific percentage of their packaging waste each year, with the percentage rising over time. Separate targets are set for each material. The goal of the program is to meet the European Union Packaging Waste requirements. EU targets are revised every five years and likewise the UK targets are also revised. Usually UK targets are slightly higher than the EU targets. Companies earning more than £2 million per year are allowed to participate in the credit trading.

The regulation divides the EPR into 4 categories and apportions the obligations to each group. Sellers share the highest responsibility (48%) followed by packer/filler (37%), converter (9%) and manufacturer (6%). So if minimum recycling target is of 18% in a year, sellers would be required to ensure that 8.6% of the packaging they handle gets recycled. The obligated companies can meet their recycling themselves either by contracting with a reprocessor or by joining a "compliance scheme" which are like PROs that fulfil all the obligations on their behalf for a definite fee. Majority of the companies join the compliance scheme.

The system works by trading of the Packaging Waste Recovery Note (PRN) at the Environment exchange among the reprocessors, obligated companies and compliance scheme. There is an active spot market for this. For every 1 ton of waste recycled 1 PRN is issued. Separate PRNs are issued for different packaging material. Reprocessors file a return quarterly to the government, stating the quantity of waste recycled by them. Government issues blank notes to the reprocessors who then fill them and issue them to the obligated companies and compliance schemes. In case of packaging waste exported for recycling, compliance is demonstrated by issuing of Packaging Export Recovery Note (PERN) which is equivalent to PRN by the accredited exporters only. The overall result of the programme clearly shows that the recycling over the years has increased. The overall recovery rate has risen 68% and material-specific recycling rates have jumped between 45% and 137%. The obligation for the compliance and the incentives earned from the tradable permits has resulted in some change in the packaging material used by the companies. Specifically, there has been a shift towards more recyclable packaging material compared to one time use materials.

The major advantage of the scheme is that obligated companies do not have to go in for recycling wastes or get into contracts with the reprocessors for the compliance; instead they can show compliance by simply purchasing the PRNs on the open market. This would provide impetus to the firms to try and reduce the material use. Fewer tons of packaging material used, smaller will be the obligations. This would lower the cost of meeting the programme requirement.

1.5 EPR – DRS in Japan

The issue of recycling E-waste in Japan is dealt with by two separate regulations – Law for the promotion of Effective Utilization of Resources (LPUR) focusing on enhancing measures for recycling goods reducing waste generation, and Law for the Recycling of Specified Kinds of Home Appliances (LRHA) which imposes certain responsibility on the manufacturers and consumers. LPUR covers computers and small sized batteries while LRHA covers home appliances like TV, refrigerators, washing machines etc. In the LPUR system the consumers need not pay any extra recycling cost (visible fee) as the recycling cost is already included in the purchase price (internalization). Consumers can dispose of the computers either directly to the manufacturers or through post offices. Retailers do not play any role in this as consumers do not return the old product at the time of the purchase due to time lag involved in transferring data and details from the old one to the new one and the retailers do not deliver them to the consumer's home.

In case of home appliances, under LRHA consumers are responsible for cost of transportation as well as e-waste recycling. Consumers pay the transportation cost to the retailers who then convey them to the collection sites, designated by the manufacturers. The law requires the manufacturers to either have their own recycling facilities or outsource it to the commercial recycling companies to fulfil their recycling obligations. The municipalities are not obliged to collect used home appliances. However they do collect it and send it to the designated collection sites. The transportation cost is paid by the consumers.

2 EPR-DRS in developing countries

Developing countries have been far slower than developed countries in implementing extended producer responsibility (EPR) in recycling of used recyclable products. However

there are several cases of EPR with different levels of success in developing countries. Some of these have been discussed in the following sections.

2.1 EPR-DRS in Taiwan

2.1.1 EPR-DRS for PET bottles in Taiwan

Lack of available space for waste disposal facilities and protest from the local residents for building of landfills and incineration plants has made waste minimization and recycling top priorities in Taiwan. The extended producer responsibility (EPR) systems under the Waste Disposal Act administered by the Environmental Protection Administration (EPA) require that manufacturers or importers of containers, batteries, cars, motorcycles (scooters), tires, oil, televisions, refrigerators, air conditioners, washing machines, computers, and printers, pay recycling fees to government recycling funds. EPA then uses the recycling funds to subsidize collection and recycling.

The Act makes it mandatory for the manufacturers or importers under the EPR scheme to register with EPA, report to EPA the amount of items sold or imported, and pay recycling fees for such items. They are also responsible for proper labelling on the recyclable products, display information about the collection points and accept goods returned by the consumers. It is mandatory for the sellers to accept the used electrical appliances from the consumers purchasing new appliances. The management responsibility of the recycling fund is with the Recycling Fund Management Committee, a centralized government body under EPA. Recycling fees paid by manufacturers/importers are distributed to Recycling Management Funds (RMFs). A major portion of the fund is used to subsidize collection or treatment of regulated items based on the certified collectors and recyclers and a portion of it is distributed to non-profit revolving funds, which are dedicated to education, research and development, audit and certification, grants for municipalities and citizen groups, and administration. The Act also has provision for penalty in case of non-compliance such as continued failure of payment of recycling fees and submission of false or inaccurate recycling fee calculation data. Such incidence is referred to the courts for enforcement.

The most important EPR scheme in Taiwan includes the deposit refund system for PET bottles started in 1989. PET manufacturers and importers were required to pay into the recycling fund according to their sales. Initially consumers were given a refund for returning PET bottles into designated collection sites which was disbursed by the recycling fund.

However payment of the refunds resulted in a deficit in the fund. The problem of free ridership, PET packaging manufacturers not registering with or reporting to the Recycling Fund Management Committee further exacerbated the problem. The system was replaced by the Mandatory deposit-refund system to bring in all the producers and a new financial responsibility was imposed on the producers. Under this system the deposit fee collected from the producers are used to pay the consumers as a financial incentive to bring back the used PET bottles to the collection point. This provides incentive and thus increases collection of PET bottles from the waste stream.

Success of the mandatory deposit-refund system depends on creation of convenient drop-off collection points, better incentive for retailers (which are often a drop-off spot,) enough financial incentives for end-users, clear labelling, and controlling measures for free riders. The major issue of free ridership resulting in deficit in the deposit refund fund is addressed by (i) controlling the involvement of the unregistered producers in the DRS with strong cooperation of the Ministry of Industries responsible for the registration of these firms, (ii) establishing measures to distinguish the PET bottles for which advance deposit fee has been paid by the manufacturers from others using bar coding and (iii) reducing the financial incentive paid to the end users. The success of the system presents a good replicable model for other developing countries to deal with the problem of waste recycling.

2.1.2 EPR-DRS for E-waste in Taiwan

The Recycling Fund Management Committee (RFMC) was introduced in Taiwan in 1998 with the purpose of reducing waste, enhancing resource collection and efficient use of resources. The main objective was to recycle difficult to process products, hazardous materials and valuable items for recovery and reuse. The RFMC system requires the manufacturers and importers to pay fees for collection and recycling of e-waste. The fee to be paid is based on the sale of the previous year and the collection and recycling cost. The fund is used to pay the subsidy by RFMC to the organizations involved in collection and recycling of e-waste. Organizations monitored by public auditing institutes are only eligible for subsidy. Those not monitored cannot claim the subsidy. Under this system only manufacturer bears the economic responsibility of recycling in the form of the fees paid to RFMC. While other stakeholders; consumers, retailers, collection firms and recycling companies receive the incentives through subsidy.

Recycling plants buy the e-waste from the designated collection site managed by specific collection firms and claim subsidy from the RFMC on recycling it. These collection firms collect the e-waste from retailers, local governments and collectors. Consumers are free to choose their route of disposal of e-waste. Manufacturers are in no way involved in any collection and recycling activity. They fulfil their EPR by just paying the fees to the RFMC. The major problem with this system is that it does not provide sufficient incentive to the recyclers to join RFMC. This has resulted in operation of several recyclers outside the scheme. Taiwan has several smaller manufacturing units and bringing then under the scheme is difficult and it would require extensive monitoring. The fluctuation in the yearly fees to be paid by the manufacturers does not provide sufficient motivation for the organizations to engage in Design for Environment activity.

2.2 EPR-DRS for E-waste in South Korea

Recycling of e-waste in South Korea was initiated in 1992 through Producer Deposit Refund (PDR) system. Under PDR, Ministry of Environment (MoE) required the producers to pay advance deposits to cover recycling cost based on the number of products shipped during the previous year. The administration with respect to the recycling and return of deposits on proper collection and recycle of the e-waste was managed by Korea Recycling Corporation (KORECO). The system had a major problem as the deposit rate was far lower than the actual cost of recycling which prompted the manufacturers to go for the deposits rather than recycling the waste. The system also allowed recycling of the e-waste by commercial recycling units via the municipality route. This created a strong possibility of improper treatment with environmental impacts. An effort to address these challenges was made by launching of Producer Recycling (PR) system in 2003. The system aims at making the manufacturers more accountable for recycling.

Under this system, MoE annually announces the item specific rates based on the recent recycling performance of the manufacturers. It also sets the recycling target for each item ranging between 55-70% based on weight. Manufacturers fulfil their obligations either by constructing their own recycling plant or outsourcing it to the commercial recycling units. They may also join the Producer Responsibility Organization (PRO) and pay the required fees to get the recycling done. In case of failure to fulfil their obligation, the manufacturers are required to pay the fee which is inversely related to the mandatory rate, in addition to

recycling charge. The role of consumers and the municipalities remain unchanged even in this system. Less than half of the total municipalities co-operate with the manufacturer, mainly due to poor financial situation of the municipalities. Manufacturers mainly focus on meeting their recycling targets rather than promoting Design for Environment (DfE). The system also requires manufacturers to collect hazardous waste but it does not make treatment after collection mandatory.

2.3 EPR for E-waste in Thailand

Efforts to have an EPR system for safe recycle of Waste Electronic and Electrical Equipments (WEEE) were on in Thailand from the early 2000s. Studies were carried out with aid from EU and Japan to come up with a suitable and effective WEEE policy. These developing countries are used as a major dumping ground for WEEE by the west. This provides highly lucrative opportunities to the downstream segment in the country. Based on the findings of these studies, the Department of Industrial Works in Thailand regulated import of all EEE older than three years in the country and came up with the deposit-refund system in 2003. The system did not receive any support from the manufacturers as they were more interested in paying the fee to government to do the recycling rather than engage in waste management to get refunded.

Presently, a new modified version of the EPR proposed in 2011 is under consideration for implementation. The proposed system was developed based on the previous policy measures and drawbacks in the operational EPR system in the developed countries. The system is based on the underlying fact that financial incentive is needed for collection of WEEE and making it available for the formal recycling. As with most of the EPR, it is based on the polluters pays principle where the manufacturers are responsible for paying the mandatory fee to support safe recycling. The Ministry of Finance will set the fee rate to be paid by the manufacturers, while the operation of the buy-back programme will be handled by Ministry of Natural Resources and Environment. The exporters are exempted from paying the fee. Provisions of the system allow discretionary power to the minister to reduce the fee for environmentally friendly products and for other socio-economic reasons. It allows flexibility of choice for the manufacturers to go for either collective or individual management of the

WEEE and then get the exemption and refunds accordingly. Fee collected will be deposited in the separate account "Product fee account" to be used to meet the direct expenses of management of WEEE like development of infrastructure, database, administration and cleaning of the sites affected by dumping of the used product or other environment management practices.

The system requires all municipalities with more than 50,000 inhabitants to have at least one buy-back centre. To further strengthen the buy-back activities, local governments either set up their own facility or give a licence to interested parties to operate buy-back centres. Retailers and repairers are allowed to act as an extension of the buy-back centres. These centres are allowed to buy used products at rates lower than the official rates. Money for the buy-back is to be provided from the local fund managed by the local government. Such a fund is created using the fee received from the manufacturers. Buy-back centres are required to transport the used product to the authorized treatment facilities without dismantling it. It is mandatory for these facilities to report to the fund the quantity of used products they get from the buy-back programme, recycle, and send to other authorised treatment facilities or disposal.

2.4 EPR for Tyres in Brazil

Brazil has a unique EPR system for recycling of used tyres in the form of an agreement as it cannot be made mandatory in the absence of corresponding Solid Waste Act and lacks legal validity. The National Council of the Environment (CONAMA) responsible for recommending policy priorities to the Federal Government and promulgating environmental norms drafted a Solid Waste Bill with provisions of EPR similar to the one in practice in EU. Till date this could not be converted into an Act mainly due to political unwillingness. In such a situation major actors - representatives of companies, government and social movements accepted a middle path in which the companies accepted not to judicially contest the Resolution and the environmental agencies would practise lenient control. Though designed as mandatory regulation, it does not have sufficient legal support to be fully enforced. Thus they were implemented as agreements.

The tyre market in Brazil comprises of the new tyre market and the used tyre market. The major chunk of the used tyre market is occupied by the remoulded tyres. Remoulding companies import used tyres which serve as a raw material, mainly from European countries and remanufacture them. They are the major rivals for the new tyre manufacturers. Import of

the tyre waste and the EOL tyres within the country led to a serious problem of improper disposal. After a series of discussions and stand-offs between the manufacturers and re-moulders on the issues of import of tyre waste and producer's responsibility for the EOL tyre disposal, the final version of the draft of the EPR policy was approved in 1999. The resolution did not allow imports of tyre waste and specified that tyre producers and importers were responsible for the collection and appropriate final disposal of tyre waste. Based on total tyre production and imports, take-back targets were defined. Targets in excess of 100% were defined so that companies were also obliged to collect the tyres that had already been dumped. Though the resolution prohibited import of tyres, still the import continues under court orders.

Under the EPR system, importers of tyre waste developed a partnership with local governments and waste scavengers and homeless people collected tyre waste and sold it to the companies. Most of the tyre waste collected under this system was used as fuel by cement kilns. Both the collection of the tyres and their treatment was financed by importers. The program was considered to be efficient and importers did not have problems in fulfilling their obligations. In 2005 itself, the number of tyres destroyed was equivalent to their total obligation for the following 10 years.

Producers of new tyres tried different solutions to deal with tyre waste, but had difficulties in fulfilling their quota. They started with a very limited infrastructure and had very few drop-off centres. This was overcome as they started creating drop-off centres in partnership with local governments. Under this scheme, mayors' offices financed the infrastructure, i.e., land, buildings, maintenance and staff while tyre producers were responsible for collecting, transporting and treating the material. These partnerships significantly reduced the companies' investment requirements. The collected tyres were burnt in cement kilns, cut and used as raw material for rubber products (shoes, seats, mats, etc), put to civil engineering uses, and fuel for a bituminous shale plant and rural furnaces. These methods of disposal show that the tyre industry had tried to avoid investments required for dealing with tyre waste. Most of the collection infrastructure was financed by local governments and the treatment infrastructure already existed.

EPR in Brazil just fulfils the requirement extending the producer's responsibilities of collecting back the EOL tyres and preventing environmentally unsound disposal. The method of disposal employed by the manufacturers and re-moulders was thermal recycling which is

considered superior only to final disposal. The system can be considered as an incomplete EPR as it partially fulfils the objectives of EPR. It does not lead to any innovation or changes in product design and makes no contribution towards enhancement of DfE.

2.5 EPR in Packaging Industry in South Africa

The government of South Africa responded to the challenge of plastic bags by imposing legislation in 2003. Legislation was effective in reducing plastic bag production and waste. But it was far less successful in terms of creating a viable plastic bag recycling industry and associated employment. South Africa has come up with the following successful example of an industry working together to address its post-consumer responsibility by removing a 100%-recyclable product from the national waste stream along with generating earning opportunities for the stakeholders. These EPR efforts have proved that the objective of successful recycling can be achieved even without any legislative interference.

2.5.1 Collect-a-can Scheme

Collect-a-Can was established in 1993 as a joint venture between ArcelorMittal South Africa (Africa's major producer of steel and tinplate, used to manufacture food and beverage cans) and Nampak (Africa's major producer of beverage cans and other packaging). The programme is a non-profit initiative that operates exclusively from funding provided by the two founding companies. Collect-a-Can is essentially a producer responsibility organisation that supports the collection of metal cans, the separation of tin from steel, the sale of recuperated material and carries out the physical recycling process itself. Its main objective is to ensure extended producer responsibility on behalf of the industry through recovery and recycling of used cans and avoid harmful legislation that may hurt the interests of the industry.

Under this scheme the collectors and consumers are paid above market prices. Collect-a-Can therefore effectively subsidises the price paid (increased price) for used cans and thereby increases the quantity of used cans supplied. The scheme also tries to keep recovery and recycling costs to a minimum, e.g. through a cost-effective operational structure and encouraging recovery at source, in order to keep the costs incurred by consumers and collectors low, therefore increasing the quantity supplied. Earlier there was no demand for the cans by the steel industry due to the presence of tin. However a voluntary initiative under the

EPR has been taken by the Arcelor Mittal, the major steel producer, to accept the cans to mix with other scrap for the production of mild steel. Collect-a-Can does not provide permanent employment for collectors, but provides them with opportunities to earn or supplement an income from selling the used cans to Collect-a-Can. It encourages and assists these collectors to start up entrepreneurial recovery and recycling operations.

2.5.2 Glass Recycling

The EPR initiative in recycling of glass in South Africa was started with the establishment of the Glass Recycling Company (GRC) in 2006. This non-profit, joint industry initiative was established through a nationwide partnership between government (DEAT); glass manufacturers; fillers, who use glass to package their products; and recyclers. GRC facilitates recovery of waste glass for recycling by promoting glass recycling, raising awareness regarding its importance, and building capacity on behalf of the glass industry. GRC does not partake in the physical recycling process. Instead, recycling is carried out on-site by South Africa's major glass producers, Consol Glass and Nampak Weigand Glass. It provides collection infrastructure (such as glass banks where consumers can take used glass for recycling) and payments to collectors, thereby ensuring a reliable supply of waste glass.

The GRC works on combined advance recycling fee/incentive system termed as advanced repurchase model, whereby provision is made for dealing with waste glass at the end of its useful life at the point of manufacturing itself. The system requires the member companies (fillers) to pay a levy at the point of purchase (essentially a PRO fee) per ton of glass bottles purchased from glass manufacturers Consol and Nampak. The levy is used to cover costs as well as to raise funds for the provision of information (in the form of education, marketing and awareness campaigns), basic collection infrastructure (e.g. glass banks) and financial incentives (in the form of payments to collectors); in order to ensure a reliable supply of used glass from both consumers and collectors. Glass banks are located at strategic locations around the country. This lowers the cost to consumers of returning waste glass, thereby increasing supply. Consumers can also get cash for glass if they take their glass to scrap dealers, entrepreneurs or buyback centres (established by glass manufacturers such as Consol), thus increasing the quantity supplied.

Setting up of entrepreneurs who pay collectors for the waste glass that they collect is another initiative taken by the GRC to increase the supply of used glass. Reliable supply from collectors and entrepreneurs is ensured by signing of an agreement between these

entrepreneurs and the manufacturers to whom they sell the used glass that the manufacturers will pay prices equivalent to that of virgin batch material. This guarantees a stable price for collected glass that is not subject to market fluctuations and also guarantees a reliable demand for used glass. The GRC relies entirely on levy payments as its only source of income.

2.5.3 PET Recycling

A not-for-profit, joint industry initiative called PETCO came into being at the end of 2004 with an aim to capitalise on the expected growth in the market for recycled PET and to act as a medium through which the PET industry would self-regulate and coordinate its recycling activities. PETCO is not involved in the physical recycling process itself. It works by undertaking activities related to EPR, such as promoting and advancing the collection and recycling of post-consumer PET, on behalf of its shareholders in the PET industry, namely brand-owners (such as Coca-Cola), resin producers, converters (who manufacture bottles from PET resin) and bottlers (fillers). As per the MoU with DEAT, there shall be no promulgation of legislation relating to PET recycling provided that the industry, through PETCO, takes responsibility for its post-consumer waste. Targets, evaluation and monitoring processes are mutually agreed upon between the two parties.

Market for the PET scrap is still immature and vulnerable to numerous information-related and technical imperfections and failures. Thus prices in this market are therefore particularly volatile. To stabilize the price and subsequent supply of the used PET, PETCO has adopted a business model of combined advance recycling fee/incentive system. A voluntary levy is paid by converters (who manufacture PET bottles from polyester resin) and bottlers (who fill PET bottles) per ton of PET resin purchased from resin producers and also by PET importers. The revenue thus generated is used to finance operational costs and to ensure a constant supply of used and recycled PET even in cases of adverse economic conditions. It is also used to support recyclers, and recycling projects and support companies promoting PET recycling. This support takes the form of subsidies per ton of material recycled, financial support for recycling operations and infrastructure, transport subsidies, and/or a safety net during adverse economic cycles. PETCO keeps the price of recycled PET artificially high when market conditions are unfavourable ensuring those recyclers and the subsequent collectors are kept in the market despite fluctuations during adverse cycles.

3 EPR-DRS in developing countries with informal recycling

The developing countries currently face a new sustainability challenge in the form of informal recycling. This informal recycling is characterised by small-scale, labour-intensive, largely unregulated and unregistered, low-technology recycling units. They neither pay taxes nor have any trading license. Thus, they fail to avail any social or economic benefits from government schemes. The main driver of the informal recycling is the viable profit margins that the unit make due to poor wages, low prices and an absence of environmental and overhead costs. The major disadvantage of having informal sector includes its distortionary effect on the major indicators like employment rate, inflation rate and growth, financial losses in the state revenue, unfair competition to the formal sector and low technological advancements. Coexistence of the informal sector along with the formal sector is mainly guided by the deficiencies and structural flaws of the formal socioeconomic, political and institutional system.

Earlier studies treated informal sector as a separate or parallel entity in economy. Recent theories have recognized a strong interdependency between the formal and informal sectors. This dependency can be either complimentary (formal sector benefits from sub-contracting) or competitive (lower cost of recycling in informal sector due to cheaper labour and low prices). Case studies from the developed countries like Germany, Austria and Belgium have concluded that informal sector has contributed significantly to the economy. While in developing countries, disadvantages dominate advantages. In these countries, informal waste recycling is carried out by poor and marginalized social groups. Studies have found that they contribute significantly to the waste recycling which otherwise may not be possible by the formal sector alone. However this is achieved at the cost of environmental hazards.

Case studies have shown that EPR in various forms implemented as a policy measure to achieve targets for waste recycling has been successful both in developed and developing world without informal recycling. Presence of informal sector in waste recycling has proved to be one of the major hindrances in success of EPR in developing countries. Over the years this has gain importance and requires greater attention due to the interdependency of the formal and informal recycling in these countries. However there are several cases where the magnitude of informal recycling has made it impossible to completely replace it with formal. Efforts to integrate the two have been found to be successful in some countries. Some of these cases have been discussed in this section.

3.1 EPR-DRS for WEEE in China

Presently, China recycles a large amount of e-waste coming mainly from waste generated through domestic EEE consumption, illegal imports of used EE products or WEEE from US, Europe and neighbouring Asian countries including South Korea and Japan and the electronics industry, one of the fastest growing sectors since the 1980s. Informal recycling is currently the prevalent e-waste recycling practice in China, especially in some coastal regions. Regulatory flaws in the relevant regulations for selective import of e-waste create enough opportunity for the illegitimate import of e-wastes in the form of mixed metal. Illegal e-waste imports provide abundant and stable supplies to the informal recycling workshops, often at favourable prices. Nearly 60% of the e-waste generated domestically is also recycled in the informal sector. The main channel of e-waste collection comprises of floating private collectors who collect the waste from households and pass it on to a number of second-hand shops and waste reclamation depots. Most collected e-waste is either sold to less developed regions after simple repair or dismantled manually and treated in unqualified household workshops or small factories to recover valuable components and materials. The existing legislative framework does not take into account the coexistence of informal recycling. This reduces the effectiveness of the available regulation on the informal sector.

Huge profit in e-waste recycling motivated some of the formal sector players to enter into this sector. Registered formal recyclers with environmentally sound recycling technology are now actively operating in EE manufacturing regions. The 'Green Box' programme initiated in 2005 jointly by Nokia and Motorola and later joined by LG, Lenovo and NEC can be considered as the first ever EPR effort for recycling e-waste in China. The programme aimed at collecting obsolete cell phones and accessories from 40 cities across China. So far this has been the most influential take-back scheme in China. But these EPR efforts failed to achieve the desired result mainly due to a supply problem caused by more efficient collection by the informal sector.

Formal recyclers do not have door-to-door collection services as informal collectors and cannot afford competitive prices for old EEEs since they have to bear significant treatment costs themselves. Usually they end up spending more on collection and treatment than the income gained from selling the reusable second-hand products and material recovery. Such low profitability of formal recyclers serves as a major hindrance in purchasing e-waste from households, aggravating the supply deficiency problem in large e-waste plants. China's informal recycling mainly thrives on sufficient supply of waste, low treatment cost and the ever increasing downstream demand.

In China, efforts by the government aiming at closure of informal recycling units have not been effective. Even in case of mandatory removal of these units, economic incentives for running informal recycling remain persistent. Such measures only result in change of operation site from one place to another or a shift of operation time from day to night. It has become evident that prohibiting informal recycling is probably not the best way ahead. Keeping this in mind, the government has come up with changes in the policy approach. It has adopted a very popular approach of setting up of recycling parks which focus on concentrating scattered individual recycling activities and improving treatment processes through central management in production and pollution control. In these parks most of the recycling is still done manually, providing job opportunities. The government is also promoting technical upgradation in the informal workshops such as replacing coal-fired grills with electrical heaters when taking out components from circuit boards etc.

In the absence of formal e-waste collection system, to establish an efficient take-back system suited to China's needs efforts are on to use the already existing household collection system run by the informal collectors. Sufficient incentives are required as a stimulus for these informal collectors to channelize the e-waste to the formal recyclers. To deal with these issues China has a new regulation based on the EPR principle – 'Regulation on the Administration of the Recovery and Disposal of WEEE', effective on January, 1st, 2011. The regulation has set up a special fund for subsidizing formal e-waste collection and treatment. Under this regulation, producers and importers are made responsible for their products. However till now there are no clear guidelines for the fund collection, product coverage, financing mechanisms and ministerial responsibilities.

3.2 EPR- in Latin America and South-east Asia

Most of the countries in Latin America and South-east Asia are facing a similar problem of WEEE and their safe EOL management. These countries have either drafted legislation for waste management using the principles of EPR or are in the process of doing so. The common problem with these countries is the active role of the informal sector in recycling of WEEE. A regular supply of WEEE and the huge profits remain the driving forces behind the informal sector. Usually they receive the WEEE from three sources – domestic EEE with unknown producers, the reuse products; both destined to be orphaned products after use, and illegitimate import of waste from the neighbouring developed and industrialized Asian and European countries. Implementation of EPR is extremely difficult if not impossible as the

producer remains unknown and strong competition with the informal sector leads to an extensive supply problem for the formal recyclers.

Efforts for recycling of WEEE in Latin America are best represented by the case of Argentina as most of the countries in the region face a similar problem. Buenos Aires City Authorities came up with a first law trying to deal with WEEE at a local level and addressing WEEE generated by the public authorities of the City of Buenos Aires. One of its main objectives was improvements in the design and production of EEE. The Bill required producers to bear several mandatory responsibilities like individual financial responsibility for the management of waste from their products. The consumers would not be charged on returning WEEE to the producers' systems and to retailers upon purchase of new product of equivalent type. Treatment facilities with some minimum technical requirements would be authorized.

The establishment of an EPR programme in Argentina faced three major challenges. The first challenge was lack of authorised treatment facilities (ATFs) and a collection infrastructure to channel WEEE to controlled facilities. Second, due to lack of awareness, Argentina does not have a culture of separating recyclables from the hazardous waste at the consumer level. Separation is done only by the waste collectors. Third, and most importantly the ATFs face a severe competition from the informal recyclers for the WEEE. The informal recyclers always have an edge over the ATFs in terms of low cost due to their non-compliance with environmentally sound practices and tax payment. Flow of WEEE to the ATFs is possible only in case they earn sufficient profits to compete with the informal recyclers by offering better price to the consumers on returning WEEE. This requires additional funds to be made available as subsidies to the ATFs by the producers. Subsidies proportional to the amount of WEEE it processes is provided only to the ATFs with official certification confirming the amount of WEEE it physically handles. The programme is yet to see any success as there are no guidelines defining the role of government as regulator.

South-east Asia is now a hot spot for recycling hazardous waste like WEEE. The absence of proper regulation and the large profit involved in informal recycling have made countries of the region like Malaysia, Vietnam, Cambodia and Indonesia a dumping ground for the developed countries. Informal recycling flourishes in these countries due to easy and regular supply of WEEE for recycling from the domestic sources as well as imported from other countries. These countries do not have specific regulation to deal with such waste. There are no EPR systems currently operational in these countries, giving enough opportunities to the

informal sector to flourish. Some of them have drafted rules for hazardous waste management focusing on formal recycling based on the principles of EPR. Currently there is very little evidence of the response to these rules and their possible outcome. The extent of success of EPR in developing countries needs further research.

3.3 EPR-DRS in India

E-waste (Management and Handling) rules 2011 came into effect on 1st May, 2012. By adopting the rules, India joined the league of countries to have specific legislation to deal with the problem of WEEE called e-waste in India. The rule is mainly based on the principle of extended producer responsibility (EPR) wherein the producer is responsible for managing such equipment after its 'end of life' once the consumer discards them. The producer is also responsible to finance and organize a system to meet the costs involved in complying with EPR. The other major stakeholders include the authorized collection centre, dismantler, and recyclers. The State Pollution Control Board (SPCB)/Pollution Control Committee (PCC) are responsible for implementing the rules in the respective states and indicate collection targets for the producers. The most important step is the collection of the e-waste carried out by designated collection centres. This collection centre can be a registered society or a designated agency, a company or an association registered with the SPCB. However, as with the previous such EPR exercises in India, this rule also fails to take into account the major role of informal recycling of the e-waste.

The EPR faces the major challenge of unknown producer and lack of e-waste supply due to the presence of informal recycling. The challenge gets further complicated in India as most of the time the first-sell transaction itself is non-identifiable because it is illegal (grey markets) or difficult to detect (assembling markets). In such cases a front-end mechanism is not applicable and such products can be considered "born-to-be orphan products". In addition to the domestic e-waste, a large amount of WEEE is illegally imported in India. The existence of grey markets makes it difficult for the EPR programme to directly address illegal transboundary movement. More over the ATFs fail to compete with the informal sector and receive e-waste much below their capacity to recycle. Such challenges raise doubts on the success of the EPR based E-waste recycling rules in India.

Appendix – II

Recycling Fee Calculation

A recycling fees charged to manufacturers and importers of recyclable waste products which is used to feed into the Recycling Fund that subsidizes collection agencies can be calculated using the following formula (based on the formula used to calculate the recycling fee rate for each regulated recyclable waste (RRW) item in Taiwan) (EPA 2012) :

$$\textbf{Recycling fee rate} = (H+L) - V - (F/S) \quad (1)$$

Where,

H = *total cost of collection, transportation, and recycling*

L = *cost of auditing and verification*

V= *total revenue generated by recyclers and collectors from processing recyclable waste*

F = *prorated trust fund surplus*

S = *quantities of new recyclable waste products put on the market*

The Recycling Fund is responsible for supporting subsidy rate, auditing and other administrative costs of the collection agencies. Hence the recycling fee charged to manufacturers and importers must be equal to the amount required for these activities.

Details of the inputs used in eq. (1) are as follows –

(i) H : Total Cost of collection, transportation, and recycling = D+T+E

Where,

D (Cost of collection, transportation, and recycling) = (C1+C2) x g

C1 : Unit cost of collection

C2 : Unit cost of recycling

g : Certified quantities from processing recyclable waste (number of units)

T (Additional Municipal Collection Costs) = 0

E (Environmental External Cost, including cost of environmental effects)

T: Additional municipal collection costs represent the cost of collecting recyclable waste which is incorrectly or illegally disposed of through municipal waste collection. Since in India, collection of ULABs is not part of the municipal waste collection system as they are not being disposed of by the residents in a manner to become municipal waste, this cost is estimated to have a value of 0.

E: Environmental external cost represents the cost of the environmental impacts of improper disposal. As ULABs are not disposed of as municipal waste so the only environmental impact during collection is due to the improper handling and storage of the ULABs by the collection system – retailers, kabadiwalas and the scrap dealers. This needs to be estimated based on a survey of the stakeholders involved in collection of ULABs. In Taiwan, this cost is estimated by the amount of subsidies given to local governments' municipal collection teams, which come from grants financed by the special income fund. Environmental cost of recycling per unit can be determined based on the investment on the pollution control devices and their running cost.

(ii) L: Cost of auditing includes funding the work of the Auditing and Certification Group (ACG), supporting the online reporting and auditing systems, and other administrative costs associated with auditing.

(iii) V: Revenue generated by recyclers from processing waste. This includes revenue generated by selling recovered materials or derivative commodities from waste. The average unit profit for recyclers and collectors is based on a market survey of derivative material prices.

(iv) F: Prorated trust fund surplus refers to the amount of money available in the Recycling Fund.

$$\text{Prorated trust fund surplus } (F) = (f - q)/ y$$

Where,

f: Cumulative trust fund surplus (accumulated annual surplus of the trust fund)

q: Amount set aside from surplus for future fund management

y: The length of a product's useful life

(v) S: Quantity of new products put on the market from manufacturing and imports.