GUIDELINES

FOR ENVIRONMENTALLY SOUND MANAGEMENT OF END- OF - LIFE VEHICLES (ELVs)

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Foreword

In CPCB's recent report ***" Analysis of ELV sector in India "*** it was estimated that in year 2015 the ELVs would amount to 87,31,185 and this figure is likely to rise to nearly two crore by the year 2025. Further this concern was also expressed in the directions of the Hon'ble NGT dated July 18th & 20th, 2016, regarding de-registration of 10 year old diesel & 15 year old petrol vehicles in Delhi NCR, the number of ELVs are expected to increase substantially in the near future. The Automobile Sector is resource intensive (material & energy), the ELV statistics indicate there is significant potential to recover, reuse and recycle material during ELV operations. ELV offers an opportunity to tap secondary resources and avoid primary non-renewable resources obtained from mining operations. Thus it is necessary to find ways about how to "create more with less" and reduce negative environmental and social impacts throughout the life cycle of resources.

Streamlining the process of material recovery has been a challenge since ELV operations are done by small scrap dealers or by unorganised sector who are unaware of the hazardous waste streams emanating from ELV operations. Recognising this need the Central Pollution Control Board along with GIZ (Indo German Environment Program) initiated a study on the development of **"Guidelines for the Environmentally Sound Management of ELVs in India"** which provides guidance for proper handling of ELVs at every stage, proposes 'Shared Responsibility' scheme and offers a platform for development of an enabling policy framework. It is hoped that this document will be helpful to entrepreneurs who foresee a market in processing ELVs in an environmentally friendly manner.

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Chapter 1
Objective and Scope of the Guidelines on ESM of ELVs

1.1 Overview of automobile sector

The automobile industry has become an integral part of human history. In India, production of automobiles took off in the early 1990s, this has become one of the country's fastest growing industry sector. In 2010 the number of vehicles were more than 110 million that included passenger vehicles, commercial vehicles, three wheelers (3W) and two wheelers (2W) (Chaturvedi et al. 2012) , a key observation was that the vehicle ownership has increased considerably. As per Society of Indian Automobile Manufacturers (SIAM), an additional 10,37,88,457 vehicles were produced in the period 2010 - 2015. In 2014-15 alone, the production was 2,33,66,246 vehicles of which 32,20,172 were passenger vehicles, 6,97,083 were commercial vehicles, 9,49,021 were three wheelers and 1,84,99,970 were two wheelers. Two wheelers accounted for 80% of vehicles sold by number and about 40% by weight.

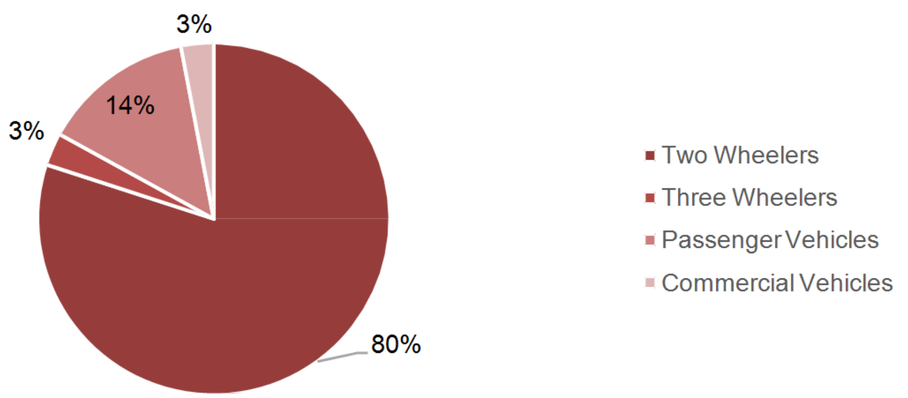

Figure 1.1: Domestic vehicle market share (%) 2013/2014 (SIAM 2015)

1.2 Defining End-of-life vehicle (ELVs)

1. When an automobile life is prolonged through repeated repair and re-conditioning, the vehicles ultimately become unusable and have to be scrapped. At this stage before scrapping, the vehicles are termed "end-of-life vehicles (ELVs).
2. According to the definition provided in European Union Directive, 2000 'end-of-life' means a <u>vehicle which is a waste.</u> The last owner usually designates a given vehicle as an ELV once it is no longer safe to drive or does not comply with emission standards.
3. In certain cases a vehicle is considered end-of- life simply due to its age. According to the EU Waste Shipment Regulations, such vehicles are not allowed to ply on the road or to be exported outside of the European Union.

4. In Australia the ELVs are those vehicles that are permanently removed from the national fleet. This can be done through several pathways, namely through damage, un-roadworthiness, vehicle age, or at the owners request.
5. The definition provided in the Automotive Industry Standards (AIS 129, AIS Committee 2015) is 'End-of-life vehicle means, a vehicle which at the discretion of its last owner is ready to be scrapped.'

1.3 Types of ELVs

ELVs are broadly divided into Natural ELVs and pre-mature ELVs. Natural ELVs refer to those vehicles that have come to the end-of-life due to wear and tear. Premature ELVs refer to those vehicles that have come to end-of-life due to unnatural reasons such as an accident, fire, flood or vandalism damage (ASM 2015).

1.4 Estimation of ELVs volume in India

Due to the increase in the vehicular population in India it has been estimated that more than 87 Lakh vehicles will reach ELV status by 2015 out of which 83% are likely to be two wheelers. For 2025 it is estimated that the number of vehicles to become ELV will be 2,18,95,439. Two-wheelers will probably account for about 80% of the total ELVs.

Table1.1: Total ELV count in 2015 & 2025

Type of vehicle	Total ELV count in 2015
Two Wheelers	72,89, 442
Three Wheelers	2,62,439
Private Cars/SUVs	7,21,558
Commercial passenger Vehicles	46,522
Commercial goods vehicles	4,11,230
Total vehicle likely to be ELV in 2015	87,31,185
Type of vehicle	**Total ELV count in 2025**
Two Wheelers	1,77,23,951
Three Wheelers	7,57,932
Private Cars/SUVs	28,09,966
Commercial passenger Vehicles	94,757
Commercial goods vehicles	11,88,833
Total vehicle likely to be ELV in 2025	2,18,95,439

1.5 Importance of resource efficiency in ELV recycling /reuse and recycling – a secondary material resource

1. ELVs contain large quantities of metal and other materials that, if salvaged or recycled properly can be effectively fed back into the economy. This reduces the environmental impacts arising from mining of primary materials.
2. Secondary metals are processed using simple technologies requiring less energy in comparison to the primary processing of metals. This further reduces environmental impacts of resource use.
3. The reuse and recycling of vehicles provides an important opportunity for transforming the resource use of societies. In India, up to 70% of a vehicle are dismantled and directly reused or sold to other manufacturers'.
4. Automobile recycling activity is known to be one of the oldest recycling activities essentially due to the presence of large amount of scrap metals. In the recycling process both ferrous and non-ferrous metals are recovered and directed to reuse. It has been estimated that passenger cars contain about 70% steel and 7-8% aluminum. The rest 20-25% is plastic, rubber, glass etc., which are also recyclable recycling one ton of steel conserves 1,134 kg of iron ore, 635 kg of coal and 54.4 kg of limestone (Sakai et al., 2013; Steel Recycling Institute 2014).
5. Finite resources are unlikely to fulfill the world economy's increasing demand for raw materials – unless production and consumption patterns around the world become more resource efficient and sustainable. An obvious symptom of increasingly scarce raw materials is rising prices. Copper prices for instance have seen a significant increase over the past years. These developments set additional incentives for ELV recycling, as improved ELV recycling can contribute to increasing the amount of recyclable material as well as to reduce waste volumes (Chen et al. 2010).
6. Metals (ex copper, aluminum etc) are mined; excessive extraction of primary materials harms the ecosystem services that are vital for human wellbeing. In order to avoid these issues it is necessary to find ways how to "create more with less" (European Commission 2015a) and reduce negative environmental and social impacts throughout the life cycle of resources.

1.6 Hazardous nature of ELV recycling

1. ELVs are known to contain hazardous substances including waste oil, lubricants, lead acid batteries, lamps, electronic components, air bags, etc. The recovery of these materials are of concerns: firstly, their recovery is often harmful to the health of the scrap recovery workers; and secondly, they cause environmental contamination if improperly dismantled or disposed. At present, nearly all of the automobile scrap yards in India are managed by the semi-formal sector. Semi-formal recyclers use crude methods to

recover materials and are poorly organized among each other and with other stakeholders of the ELV value chain.

1.7 Challenge in recycling ELVS

1. There are several challenges to be dealt regarding increasing the efficiency and sustainability of ELV recycling in India as some of the wastes are economically valuable materials. This matter is of larger concerns due to (a) the growing demand for vehicles and (b)anticipated huge growth of ELVs
2. The resources present in these ELVs are significant and to address the environmental impacts requires an 'Environmentally Sound Management' approach for ELVs in India. Presently recycling of ELVs sector is lacking an enabling framework. Existing regulations for the channeling of hazardous materials include the Hazardous Wastes (MH&T) Rules (2008), Batteries (M&H) Rules (2001) and E-waste (M&H) Rules (2011), all these Rules have been revised in year 2016. However, the lack of standard operating procedures (SOPs) of a licensing system and of responsive concerned authorities regarding the handling of ELV waste remains a major issue.

1.8 Objective and Scope of the Guidelines

The development and formalizing Environmentally Sound Management (ESM) of ELVs in India is likely to face considerable challenges from various stakeholders they include:

- The manufacturers, recyclers, traders, customers and other participants of the value chain will need guidance on how to proceed with recycling in an environmentally friendly manner.
- On the other hand the policy makers will require inspiration for the development of a policy framework that encourages and guides the transformation of the ELV sector.

These guidelines are intended to provide insight and guidance on the following topics:

a) **Environmentally Sound Management (ESM) of ELVs**
   - Insight into internationally renowned procedures and technologies for the ESM of ELVs
   - Comprehensive framework for the ESM of ELVs in India, including detailed description of the following procedures:
     i. Declaration of ELVs, deregistration of vehicles and ownership transfer
     ii. Collection and channelization of ELVs
     iii. Repair and refurbishment, dismantling and recycling
     iv. Identification of residues and processing for safe disposal
     v. Setup of ELV recycling facilities
     vi. Design and implementation of a Shared Responsibility scheme

b) **Policy framework for ESM of ELVs**

- An insight into the various regional and national policy frameworks for ELV management
- Recommendations for a policy framework for ESM of ELVs in India, including
  - Definition of ELVs and other related definitions to be covered
  - Responsibilities of various stakeholders
- Compliance requirements under the prevailing legal framework in India in order to ensure safe dismantling and recycling of ELVs until a comprehensive regulatory framework is enforced

c) **The way forward**

- Specific guidance for possible contributions by various stakeholders
- Recommendations for the next steps to be taken

All stakeholders in the ELV as well as the automobile industry value chain may use these guidelines: the component manufacturers, automobile manufacturers / original equipment manufacturers (OEMs), consumers, automobile service centers and automobile dismantler and recyclers including the transporters of ELVs.

1.9 Guidelines for Environmentally Sound Management of End-Of-Life Vehicles (ELVs)’

Taking an important step to fill this gap, this document ‘GUIDELINES **FOR ENVIRONMENTALLY SOUND MANAGEMENT OF END-OF-LIFE VEHICLES (ELVs)’** provides guidance for proper handling of ELVs at every stage, for the setup of a ‘Shared Responsibility’ scheme and for the development of an enabling policy framework. Whenever applicable the guidelines make reference to the Automotive Industry Standards for End-of- Life Vehicles (AIS 129) that were published by organizations of the Indian automotive industry in 2015 (AIS Committee 2015). These standards provide guidance for the collection and dismantling of ELVs by authorized centres and describe provisions that manufacturers should take in order to increase the recyclability of vehicles. However, these standards need to be further developed into a regulatory framework in order to ensure compliance by the owners, semi-formal sector and develop recycling potential to make vehicle manufacturers responsible for their vehicles throughout their entire life cycle.

Note : ‘Semi-formal’ sector in this document refers to the actors in the chain in recycling of ELVs that do not belong to ‘formal’ sector.

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Chapter 2

International framework for Environmentally Sound Management of ELVs

2.1 An estimation of generation of ELVs globally

The global ELV generation is estimated to be 40 million ELV/ year; this accounts for 4% of total global automobile ownership. (Sakai et al. 2013). The European Union (EU) generates approximately 9 million tons of ELVs every year (Eurostat 2015) and has made producers responsible for the treatment of ELVs. The treatment of ELVs was identified as a major challenge in Japan as every year approximately 5 million automobiles are taken off the roads. In US approximately 12-15 million vehicles and in Canada about 1.2 million ELVs (Wordsworth 2011) are generated annually. The global rate of ELV generation is increasing and there is need to ensure that these ELVs become resources for future automobile manufacturing.

2.2 A brief overview on ELV policies globally

1. The automobile recycling has attained a professional status and is a formal industry in several countries. The infrastructure for recycling has been developed gradually with the increase in the production of vehicles in Europe, the U.S. and other countries. Many countries have already begun establishing ELV management systems.
2. In general, one can differentiate between two types of ELV management systems:
    a. direct management systems based on legislation and
    b. Indirect management systems based on market mechanisms and environmental regulations.
3. While the EU, Japan, Korea, China and Taiwan have established direct legislative ELV recycling systems, the US, Canada and Australia are managing ELV recycling under existing laws on environmental protection.
4. Those countries that have a legislative ELV system usually set national targets for ELV recovery rates, many aiming for more than 95% recovery. In 2013, countries such as Russia, **India,** Mexico, Turkey and Vietnam were making preparations for introducing legislative management systems for ELV recycling.

Table 2.1: International ELV policy overview (Sakai et al. 2013; Chen et al. 2010)

Country	Year	Legislation
EU	2000	EU Directive 2000/53/EC on ELVs
Japan	2005	Law for the Recycling of ELVs
Korea	2008	Act for Resource Recycling of Electrical and Electronic Equipment and Vehicles
China	2001	ELV Recycling Regulations

	2006 2008	Automotive Products Recycling Technology Policy Regulations on Pilot Remanufacturing of Automotive Parts
Taiwan	1994	Waste Disposal Act, including ELV Recycling Guidelines

5. While pioneering countries can be a good reference for understanding the process ELV recycling further, however a common concern is dealing with the 'ELV handling'. Several countries that engage in ELV practices have inadequate health and safety measures for workers employed in such facilities. For instance, in the process of de-pollution and dismantling of ELVs having labelling policies / sharing information on hazardous substance embedded in ELVs would be helpful.
6. Another area that can facilitate ELV management is the design of the vehicle wherein R&D and innovation in the use of environmentally friendly sustainable materials and production process. The increasing computerization in vehicles - electric and hybrid passenger cars in countries such as Germany for instance pose new challenges to ELV recycling. The above could make ELV recycling safer, more effective and more efficient.

2.3 De-registration of vehicle as an 'ELV ' and CoD

1. The process of de-registration for vehicles that have reached their end-of-life is mandatory in almost all countries.
2. The first steps in the ELV processing chain is an automobile's declarations as an ELV is it's de-registration and issuance of a certificate of destruction (CoD).
3. It should be noted that the number de-registered cars in a country need not necessarily equal the number of ELVs as not every de-registered car is declared an ELV. De-registered automobiles can also include cars prepared for export, cars used within private sites and cars that are illegally dumped as waste. (Sakai et al. 2013) In practice, there are different approaches for de-registration across the EU member states. While in most countries de-registration takes place when a car owner wishes to dispose of its vehicle, however in few countries de-registration is compulsory every time the ownership of the car changes (e.g. Austria). (Schneider et al. 2010).
4. In **Taiwan**, de-registration had traditionally only required the car owner to hand over the car's license plate to a Motor Vehicle Service Station (MVSS). As the ELV was thereafter still considered to be the owner's property, there were no mechanisms in place to monitor the subsequent use of the ELV. This led to low ELV recycling rates. A recent amendment to Taiwan's Waste Act now obliges car owners to hand in their ELV to a legal recycling operator. The recycling operator then issues a certificate that is considered a required document for deregistering a car at the MVSS. (Chen et al. 2010).
5. In **Japan**, car owners can only de-register their cars after they have

been notified by the respective dismantling facility that their car has been successfully dismantled. (Zhao and Chen 2011).

6. General indicators for when a car is declared ELV include its age, emission conformity, and technical safety. In most countries, the latter two are periodically examined by independent organizations. In the US, Canada and Germany the frequency of the check is around every two years. If a vehicle does not pass the check, the owner may decide whether to upgrade the vehicle to meet the required standards (if possible) or to declare it as ELV. Once the vehicle is declared as ELV it is to be de-registered.
7. In most countries de-registration of the vehicle is done by the authorities or agencies that register the vehicles for plying on road. The de-registered vehicles are removed from the road and no further road tax is paid. When the de-registered vehicles are accepted as ELVs for recycling, the recycling company carries out the recycling procedures and at the end of it provides a certificate of destruction (CoD) which completes the disposal of the vehicle. In the EU, a certificate of destruction (CoD) is issued by the dismantlers / recyclers.
8. In the **EU**, the presentation of a certificate of destruction (CoD) is a condition for the de-registration of an ELV. The certificate is issued to the holder/owner of the vehicle when it is transferred to an authorized treatment facility (ATF). In case a producer, dealer or collector takes responsibility for transferring the ELV to the treatment facility, he may also issue a certificate of destruction on behalf of the ATF. All certificates of destruction issued in the EU are to be mutually recognized in all member states. (European Parliament and Council of the EU 2000). In the **UK**, Certificates of Destruction (CoD) are required for all passenger vehicles and light goods vehicles under 3.5 tonnes, as well as for all 3-wheeler motor vehicles. The CoD are issued by the ATF but generated through an online system operated by the Environment Agency. That way, the national vehicle record is automatically updated with each CoD issued. (UK Environment Agency 2014)

2.4 Global practices : Collection and transfer of ELVs

1. The collection and handling of vehicles declared as 'ELV' usually begins with the transfer of the ELV to a designated treatment facility where the actual de-pollution, dismantling and recycling processes take place. There are different modes of organizing this transfer.
2. In the **UK**, the transfer of ELVs to the authorized treatment facilities is facilitated via two main free take back service providers, namely "Autogreen" and "Cartakeback". They both operate within a network of ATF throughout the UK. (SEPA and NIEA 2015)
3. In the **Netherlands**, the Dutch automobile industry has established "Auto Recycling Netherland" (ARN) which is responsible for the collection of all scrap vehicles as well as for overseeing the dismantling and recycling process. The collection is without cost to the last owner.

The system is financed through a waste disposal fee that is to be paid in the course of the initial vehicle registration. For the actual collection of the ELVs, ARN enters into contracts with other service provision companies. (U.S. Environmental Protection Agency 2013)

4. In **Taiwan**, the legal framework provides for two different modes of ELV collection. First, there is a financial reward scheme in place to encourage citizens to voluntarily turn in their ELV after having it de-registered. Secondly, the environmental police authority is entitled to remove deserted ELVs on roadsides. Collection points for ELV are service stations and car dealers. (Chen et al. 2010)

5. In **China**, the collection of ELVs is organized via around 800 "take back stations" that are spread in bigger cities around China. Car owners usually sell their cars to these take back stations, with the price calculations being based on the car's metallic content and the current scrap metal market price. (Zhao and Chen 2011)

2.5 ELV recycling activities: Environmentally sound de-pollution, dismantling, shredding, material recovery and disposal of ELVs

The environmentally sound recycling process of ELVs comprises four major stages and is depicted below:

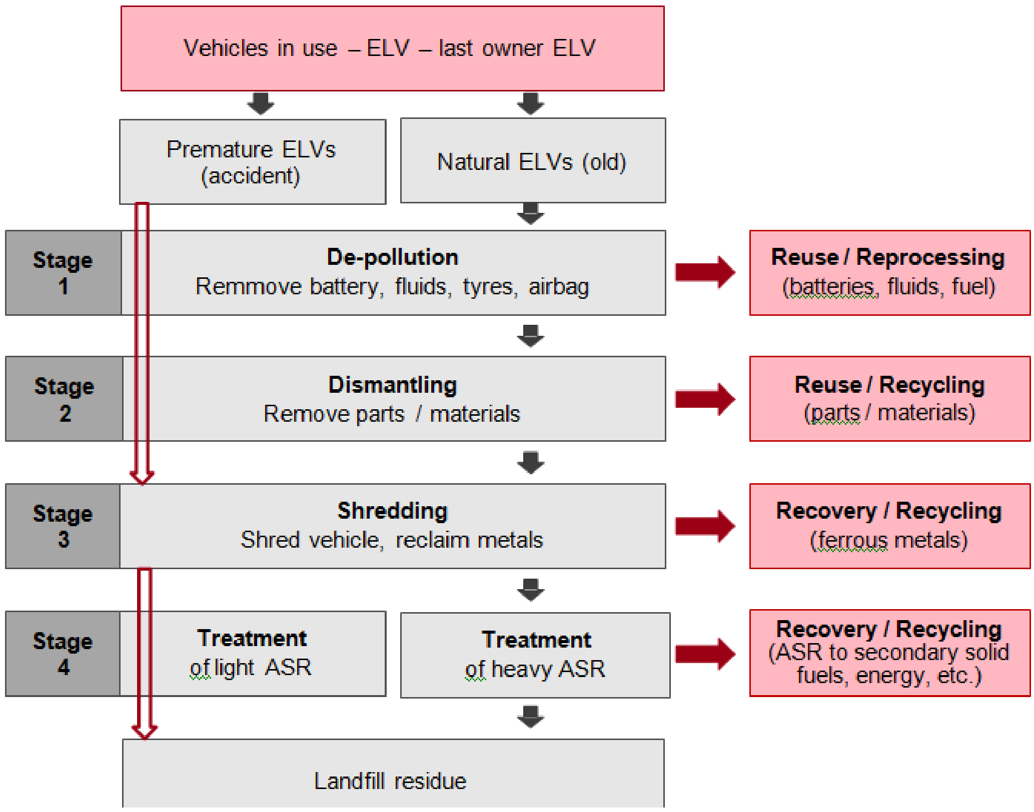

Figure 2.1: Stages of ESM of ELV

1. De-pollution: The recycling of ELV process starts at the dismantling or treatment facility where it is first de-polluted and then dismantled (sometimes these two steps are summarized as "dismantling"). De-pollution includes removing hazardous components and substances such as the battery, fuel, other fluids, airbags and any parts containing mercury. As the removed materials are either explosive or corrosive de-pollution must follow strict health and safety rules and contamination of the environment must be prevented. This includes storing hazardous components and materials separately and providing adequate training for employees. (UK DEFRA 2011).

2. Dismantling: Once the vehicle has been de-polluted it is then dismantled. This process involves segregating and collecting recyclable and reusable components, including engines, tyres, bumpers, and other parts. The degree of mechanization of the dismantling process depends on the costs of labour and availability of large scale technology (Tian and Chen 2014). The recovered components and fluids are sold for reuse in other vehicles (motor parts, batteries, fuel, etc.) or for further recycling (tires, valuable metals, carpets, etc.). According to experiences from the EU and Japan the car hulks weigh approximately 55–70% of their original weight after dismantling (Sakai et al. 2014).
3. All waste water that is produced during the de-pollution and dismantling processes must be treated. Resulting waste material is sent to incinerators for energy recovery or to landfills for disposal. (Chen et al. 2010)

4. Shredding / ASR :
    a. ASR is a highly heterogeneous mixture of residual ferrous and non-ferrous metals (5–23%), plastics (20–49%), rubber (3–38%), textile and fibre material (4–45%), wood (2–5%), and glass (2–18%). Some of these components can be further processed: heavy ASRs are molten for the recovery of valuable non-ferrous metals such as aluminum and copper; combustible materials are used to make fuel substitutes; etc. However, these components are difficult to separate from other materials such as ash and heavy metals. Therefore, it is more common to either use ASR for energy recovery or to send them directly to landfills.
    b. According to experiences from the EU and Japan the car hulks weigh approximately 55–70% of their original weight after dismantling (Sakai et al. 2014). The remaining hulk of the vehicle is crushed so that it can be transported in a compact and cost-effective form to the shredder facility. There it is broken up into fist-sized pieces by large shredders. The shredded material is then separated into ferrous metals for material recovery as well as non-ferrous metals (heavy automotive shredder residue (ASR)) and other materials (light ASR). The separation process is realized by complex machinery such as magnetic separators, air classifiers, infrared systems, etc.

(Sakai et al. 2014; ARS et al. n.d.). Processing scrap in smelters usually produces secondary metal.

c. Several countries have high targets for the recycling rates of ELVs, the recycling of ASR thus becomes increasingly important.

5. ELV recycling facilities Within the overall ELV recycling chain, the management of ASR is one of the most problematic steps and requires further technological advances. (Vermeulen et al. 2011)
   i. **In EU,** the recycling of ELVs is organized under an Extended Producer Responsibility Scheme, according to which manufacturers are responsible for increasing recyclability of vehicles, disseminating information on recycling procedures and providing free take-back of ELVs. (Sakai et al. 2013).
   ii. The **EU ELV** Directive determines that by 2015 all member states have to reuse, recycle or recover 95% of an ELV by weight. Out of this, energy recovery must not exceed 10%. The **EU** ELV Directive obliges all member states to ensure that all ELVs are transferred to authorized treatment facilities (European Parliament and Council of the EU 2000). In 2006, a total of 8,000 authorized ELV dismantlers operated within the EU-25 territory, complemented by 232 shredding facilities. At the same time, there remained a considerable number of illegal treatment facilities, particularly in those countries that did not have a sound ELV recycling system. Successful counter-measures include a national campaign launched by the UK Environment Agency in April 2008 that reduced the number of illegal ELV and scrap metal sites by 50% within one year. (EU 2010), With regard to ASR recycling the **EU** attempted to reduce the amount and hazardousness of ASR by intensive dismantling; another strategy is post-shredder treatment.
   iii. In **Germany**, dismantling facilities are responsible for de-polluting as well as dismantling of ELVs. In 2014, there existed approximately 1300 registered dismantling facilities (UBA 2014). They are under strict obligations with respect to organizing the process. These requirements relate to the dismantler's structure, equipment and operation, as well as to its documentation procedures. Additionally, dismantling facilities need to pass an annual certification by an external expert. Shredding is realized by shredding facilities which have to comply with similar obligations. (Kohlmeyer 2012)
   iv. In **Japan**, vehicle manufacturers and importers are required by law to take back and recycle air bags and ASR, and to ensure sound treatment of fluorocarbons. The recycling rates for air bags and ASR are 85% and 70%, respectively. The costs of recycling the mentioned components are borne by vehicle users who, at the moment of buying a new car or handing in an old car, are required to pay a recycling fee. Collection of refrigerant gases is mandatory as well and falls under the responsibility of refrigerant gas processors. However, no recycling rate was determined for these gases. (Sakai et al., 2013; Wang and

Chen 2013) The processing of other components or liquids is done voluntarily by dismantling and shredding facilities. In 2007, 5000 dismantling and recycling operators and 140 shredding plants were registered. There exists no recycling rate for the overall weight of the ELV. (Chen et al. 2010)

v. In **Korea**, ELV recycling is done by the dismantling and shredding facilities. For 2015 and onwards, a material and energy recovery of ELVs of 95% was determined. This includes a maximum energy recovery rate of 10%. (Serona et al. 2010) ASRs are land-filled or incinerated (Sakai et al. 2013).

vi. In **Taiwan**, ELV recycling is realized by dismantling and recycling operators. In 2009, there were 303 recycling operators and five shredding and sorting plants. These operators work along three different business streams: a) trading of scrap metal and reusable parts, b) trading of spare parts after the dismantling process, and c) export of ELVs and used cars. ASRs are disposed of in waste processors, incinerators or landfills. (Chen et al. 2010)

vii. In **China**, ELV recycling is realized by dismantling facilities. The reuse of five major vehicle assemblies (i.e. engines, steering, transmissions, axles and frames) is currently allowed only for selected pilot facilities. (Wang and Chen 2013) By the year 2017 the recycling rate of ELVs should reach at least 85% (Sakai et al. 2013).

viii. In the **U.S.** ELV recycling is voluntary and driven only by the economics of recycling. However, all steps of ELV recycling are subject to monitoring under environmental law (Sakai et al. 2013). While the processing of most components is organized in a de-centralized manner by the different actors of the ELV recycling chain, there exist nationwide efforts for the collection and recycling two particular contaminants, namely mercury switches and vehicle tyres. With respect to mercury switches, a broad coalition of federal, state, industry and environmental non-profit partners in 2006 have created the National Vehicle Mercury Switch Recovery Program (NVMSRP). The return of switches under the NVMRSP is rewarded financially, through a fund set up voluntarily by steel and auto manufacturers (U.S. Environmental Protection Agency 2013). ASR that results from ELV processing is land-filled.

2.6 Responsibilities throughout the life cycle of vehicles – an overview

1. The above mentioned activities w.r.t. ELV handling require the co-operation of all stakeholders of the vehicle and ELV value chains. In order to optimize the various processes it is important to clearly define the responsibilities of vehicle owners, government agencies, vehicle service centres, collection and recycling facilities and other stakeholders.
2. Vehicle manufacturers are key stakeholders. Their decisions directly affect the recyclability of their products, i.e. through the choice of

material, car design, and other aspects. Furthermore, as they are larger, better endowed (resources, infrastructure, information) they effectively guide independent recycling facilities. Therefore, many countries around the world now encourage 'producer' responsibility throughout the life cycle of vehicles.

3. One approach is the 'Extended Producer Responsibility (EPR)', an environmental strategy that makes the manufacturer or importer of the product responsible for the entire life cycle of the product. This responsibility starts at the design stage of the vehicle. Here, manufacturers should reduce the overall environmental footprint of their products by reducing the use of toxic and hazardous substances; increasing the use of recycled constituents; enhancing the ease of disassembly; and so on. Another important responsibility of producers is to provide for the take back, recycling and final disposal of the product (Lindhqvist 2000). The producer's responsibility for a product is hence extended beyond the 'manufacturing' to the 'post-consumer stage' of a product's life cycle (OECD 2001).
4. EPR can be managed either individually or collectively. 'Individual producer responsibility' (IPR) means that the producer (manufacturer or importer) takes responsibility individually for its own products throughout the entire life cycle including the collection and 'end-of-life management' through 'take back' or any other system. 'Collective Producer Responsibility' (CPR) is when a number of producers, manufacturers, importers and other stakeholders come together as a consortium or establish an organization to take collective responsibility for the end-of-life management of products manufactured or imported. Such organizations are often called the 'Producer Responsibility Organization (PRO)'. They function on behalf of producers and are responsible for collection and channelization of end-of-life products for environmentally sound recycling (Lindhqvist 2000; OECD 2001).
5. Besides EPR there exist a number of other approaches (shared responsibility, product stewardship, etc.) that are characterized by varying degrees and nuances of producer responsibility. A country's approach ultimately depends on the characteristics of the stakeholders in the production, service, recycling and waste industries; on the existing regulatory framework; and on other specifications.

2.7 Responsibilities throughout the life cycle of vehicles: Country examples

1. At **EU level**, the ELV Directive (2000/53/EC) stipulates the principle of producer responsibility. Material and equipment manufacturers are obliged to use common component and material coding standards. For each new type of vehicle entering the market, the producers are obliged to provide dismantling information within 6 months after the vehicle has entered the market. The information provided shall help

treatment facilities to quickly locate all hazardous substances assembled in the car. The use of mercury, lead, cadmium and hexavalent chromium in vehicles is forbidden. (European Parliament and Council of the EU 2000) Further, the ELV Directive mandates that vehicle owners must be allowed to return their ELVs to authorized treatment facilities free of charge. The costs of ELV recycling must be borne by manufacturers. (European Commission 2005)

2. In **Germany**, the producer responsibility principle obliges car manufacturers and importers to take back ELVs free of charge. (Kohlmeyer 2012)
3. In the **Netherlands**, a vehicle's first owner pays a recycling fee to the manufacturer, seller, or importer from whom he purchases the car. (Chen et al. 2010)
4. In **Korea**, producers and importers are held responsible for the use of hazardous substances, recyclability of materials, ELV collection and information exchange. They are legally required to provide technical support to scrap dealers and ELV recyclers and to pay for costs if they exceed the benefit of recycling. The respective provisions are laid out in Korea's 2008 Act for Resource Recycling of Electrical and Electronic Equipment and Vehicles (U.S. Environmental Protection Agency 2013). Before this Act, Korea employed an EPR approach in its waste management policy. With the 2008 Act this EPR approach has been developed into an "Integrated Product Policy" that introduced a so called "eco- assurance system". This eco-assurance system follows a two sided approach to product responsibility, including both preventive actions (environmentally friendly design and manufacture of products) and follow up management (environmentally sound waste management). (Sakai et al. 2013)
5. In **Japan**, the 2002 ELV Recycling Law provides for a "shared responsibility principle" that obliges consumers to pay a fee when purchasing a new car or when handing in an old car that was bought before the law was enforced (U.S. Environmental Protection Agency 2013). The fee is deposited into a deposit management entity and operated by an electronic management system that confirms the actual ELV recycling. According to the Law the responsibilities of automotive producers are the following: they should design for recycling; provide dismantling information to the recycling operators; take back and recycle airbags, ASR and fluorocarbons; record waste recycling; specify the charging standard; and mark their name on the vehicle before selling it (Wang and Chen 2013).
6. In 1994 the **Taiwanese** Environmental Protection Administration established a Recycling Fund Management Board responsible for collecting a recycling fee. This so called "Collection Disposal Treatment Fee" is collected from responsible enterprises (vehicle manufacturers, importers and sellers) and used for recycling activities and related tasks. (Chen et al. 2010)

7. In **China** the “Technology Policy for Auto Products Recycling” (2006) stipulates the strengthening of automotive producers’ and importers’ responsibility but so far not much progress has been made in that sense, thus the majority of costs for recycling are borne by the recycling operators. In 2008 standards were proposed that make producers responsible for determining and marking the recoverability of different automobile parts. Furthermore, they must not use substances that are listed on the List of Disabled/Restricted Substances for Automotive Products. (Wang and Chen 2013)
8. In the **Unites States**, there is no federal law governing EPR practices. The term usually used for EPR-related activities is “product stewardship”. The concept of product stewardship addresses producers, manufacturers, retailers, users and disposers alike and holds all these parties responsible for the reduction of a product’s impact on the environment. (U.S. Environmental Protection Agency 2013)

2.8 Responsibilities throughout the life cycle of vehicles Company examples:

1. Some of the automobile manufacturing companies such as BMW and Volkswagen in Germany as well as Toyota and Nissan in Japan are known to facilitate the recycling and recovery of components and parts from the ELVs of their own brand. Such companies either set up their own recycling plants or support recycling units. They also prescribe procedure for the handling and recycling of their vehicles along with schematic diagrams in the form of brochures.

2. The **BMW Group** makes a commitment to the environment by manufacturing energy saving vehicles, environmentally sound production process and environmentally friendly recycling. The BMW Group has acknowledged that the used cars are potential sources of secondary raw materials and aims at contributing to the conservation of natural resources through recycling. BMW Group started anchoring environmental protection policy within its organization in the early 1970s. The Group has started to establish a network of take back centres for the acceptance and recycling of vehicles as far as the early 1990s. Today, all ELVs returned to these centres are processed by authorized treatment facilities. For coordinating and promoting its efforts in ELV recycling, BMW Group has established a “Recycling and Dismantling Centre” in Munich, Germany that does on the one hand serve as an authorized treatment facility itself and is on the other hand engaged in research and development for creating recycling concepts for future vehicles. (BMW Group 2009)

3. **In 2007, the Volkswagen Group** published a strategy on how to achieve the recycling and recovery rates as prescribed in European and

German ELV legislation. According to the strategy the Group has various standards in place to ensure environmentally sound product development, including standards for marking product parts, material documentation, material restrictions and others. The company cooperates with material manufacturers and suppliers to reduce hazardous substances in their vehicles and to ensure efficient recovery and dismantling. Volkswagen ELVs can be returned to a large number of take back facilities operated by a Volkswagen subcontractor. All necessary information for dismantling and recycling is made available to the take back facilities via the "International Dismantling Information System" (IDIS, http://www.idis2.com), an online platform that was established together with a large number of international car manufacturers. In order to achieve the 95% ELV recovery target by 2015 Volkswagen provides information and works on technologies for both component dismantling and post-shredder treatment. It runs its own operations for reuse of components after treatment. (Hackenberg and Hildebrandt 2007)

4. The **Toyota Motor Car Company** started a joint venture with Toyota Metal Company in 1993 to develop ASR recycling technology and built the first automobile recycling plant in 1998 in Japan recycling 15,000 cars per month. This plant has an ELV shredder plant and an ASR recovery plant where they developed the technology to use shredders for ferrous and non-ferrous metal chunks and Shredder Residue Fines (SRF) leaving no residue for disposal after ELV recycling. The resin which is the largest constituent of shredder residue is used as substitute fuel. They also recycle and reuse glass from ELVs. Toyota is continuously investing in R&D on recycling technologies with the objective to achieve zero waste for disposal from ELVs. (Toyota Motor Corporation 2014)

5. **Nissan** has addressed the 3R principle of Reduce Reuse and Recycle and has a dedicated Recycling Promotion Department to develop and implement appropriate and efficient methods to handle ELV recycling in the future. Nissan is working on the standardization of recycling technologies to incorporate them in the design stage. ELV management at Nissan is divided in two stages. One stage is the development stage where the use of heavy metals such as lead mercury, cadmium and hexavalent chromium is avoided and the design is adjusted for easy dismantling and recycling. Their approach also considers recycling without down cycling or losing any material quality. Nissan recycles iron, aluminium and lead yet they are often challenged by a mix of materials which is difficult to separate. Research on dismantling continues to harness ways and means to effectively recycle material and reuse parts. (Nissan 2004)

6. The **U.S.** automotive industry assumed part of its responsibility for a more sustainable automobile industry by forming the Vehicle

Recycling Partnership in 1992. Under this partnership manufacturers such as Ford, Chrysler and General Motors coordinate collaborative research programmes to promote sustainable ELV recycling in North America and globally. (U.S. Environmental Protection Agency 2013)

2.9 International Framework

1. There are two distinct approaches with regard to policy frameworks for ELV prevailing in most countries: Under the first approach a legislative/regulatory framework is in place that mandates the activities pertaining to ELV recycling and disposal; under the second approach no dedicated ELV law is in place and stakeholders follow guidelines provided by authorities or the automobile manufacturing companies or their associations; this guidance is not mandatory. Below it is listed which approaches different countries belong to.

2. In the **United States** ELV recycling is managed under the existing environmental protection laws and guidelines for recycling efficiently. In the **EU, Japan, Korea, and China** ELVs are regulated under a specific ELV legislation that mandates the activities pertaining to ELV collection, recycling and recovery of resources. A comparative account of the global policies, responsibilities and targets is presented in the table below:

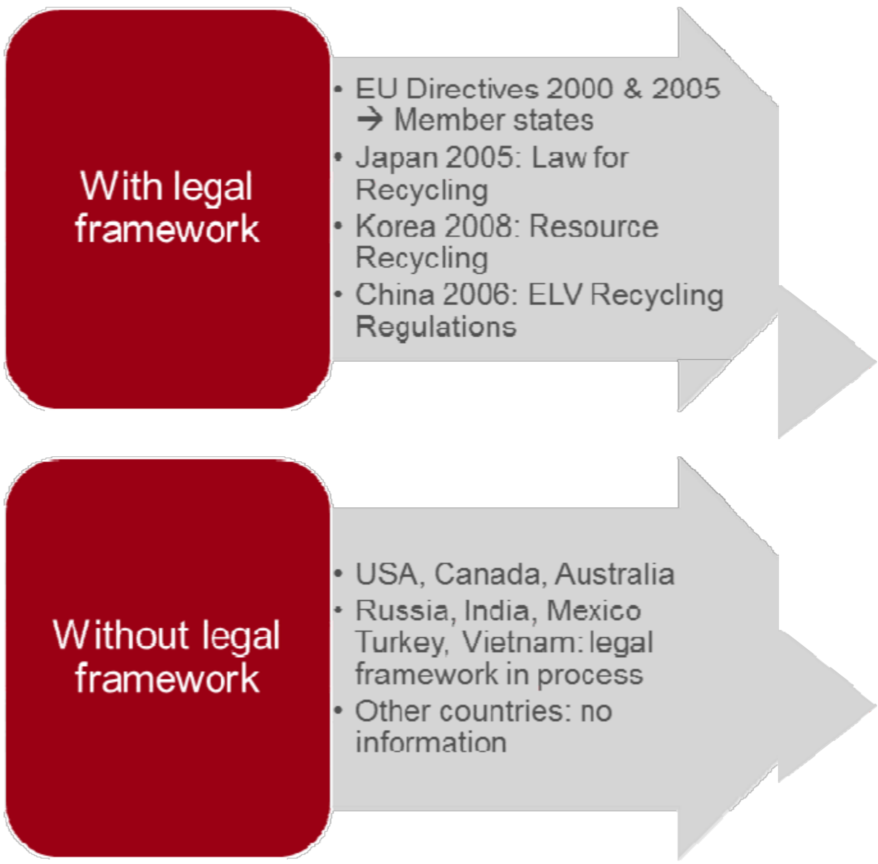

Figure 2.2: ELV policy framework

Table 1.2 : International comparison of ELV systems (Sakai et al. 2014)

	EU	Japan	Korea	China	USA	India
Background	Abandoned Automobile ASR disposal, Auto Dismantling and recycling activity	Illegal dumping of ASR, lack of disposal sites and Maximise use of resource recovered	Effective use of ELVs as resources	Illegal assembly effective use of resource recycling economy	ELV Recycling for resource recovery	Informal Sector Activities
Policies & Regulations	ELV LAW EU Directive 2000/53/EC on ELV Sep 2000 Revised I 2005LAW	ELV LAW ELV Recycling Rules 2002 enforced 2005	ELV LAW Resource Recycling of EEE & ELV 2005 in enforce form 2008	ELV LAW ELV Recycling Regulation 2001 ELV Recycling Technology Policy, 2006	NO ELV LAW Environment Laws RCRA Clean Air Act, etc. & Market Mechanisms	NO ELV LAW Environmental Laws Hazardous Waste Rules 2008, Batteries Rules 2001, E-waste Rules 2011
Recycling Responsibility	**EPR** Producer responsible for free take back & to incur recycling cost	Sustainable Recycling Society under 3R Shared responsibility owner, manufacturer Collector & recycler	**EPR** Automobile Manu-facturers & importers respon-sible for recycling incur cost	Traded as valuable secondary resource	No regulations traded as valuable secondary resource Market driven	No regulation Economics of recycling & employment in informal sector for urban poor

Recycling Target & Achievement	reuse+ recovery Target (achieved) 2006 - 85% (80%) 2015 –95% (85%)	No recycling Target Airbag recovery 85% ASR use 70% 2015 50% 2010 30% 2009	Material +energy recovery : Until 2014 85% After 2015 95%	Possibility of recycling: 2010 ~ 85% 2012 ~ 90% 2017 ~ 95%	No specific goals 95% of ELV for recycling 80% material recycled	No specific targets market driven activity
System Characteristics	EPR based Principle Regulation to prohibit use of Heavy metals Enforcement of Domestic Laws	Automobile Manufacturer & importer responsible for recycling No recycling Targets Thermal recovery of ASR	EPR based Planning as per ELV prices Operations under Eco-assurance system	ELV Recycling Regulation to prevent accidents. No recycling of axle, engine, steering, frame and transmission Remanufacturing Regulation 2008	No regulatory System Motor Vehicle Information system Automotive Recycling Association	No assessment for ELV deregistration procedures not followed Recycling mostly in the informal / unorganised sector

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Chapter 3

Overview of the existing ELV recycling sector in India

3.1 Classification of automobiles

1) In order to manage the ELV in an environmentally sound manner the type of vehicle that will be scrapped needs to be known. Automobiles or vehicles can be classified on the basis of:
   i. *Load*
   ii. *Number of wheels*
   iii. *Fuel used*
   iv. *Body (size)*
   v. *Source of the vehicle*
   vi. *Condition of the vehicle* (ASM Auto Recycling 2015)

2) Classification of automobiles based on **:** Load
   a. Heavy transport vehicle (HTV) – trucks, trailers etc.
   b. Heavy motor vehicle (HMV) – buses.
   c. Light transport vehicle (LTV) – pickup, station wagon, etc.
   d. Light motor vehicle (LMV) – cars, jeeps, etc.

3) Classification of automobiles based on **:** Number of wheels
   a. Two wheeler vehicle – Scooter, motorcycle, scooty, etc.
   b. Three wheeler vehicle – Auto rickshaw, three wheeler scooter for handicapped persons, speed, etc.
   c. Four wheeler vehicle – Car, jeep, trucks, buses, etc.
   d. Six wheeler vehicle – Big trucks with two gear axles.

4) Classification of automobiles based on **:** Fuel used
   a. Petrol vehicle – motorcycle, scooter, cars, etc.
   b. Diesel vehicle – cars, trucks, buses, etc.
   c. Electric vehicle – which uses battery and electric motor to drive.
   d. Steam vehicle – engine which uses steam engine (now obsolete).
   e. Gas vehicle – LPG (liquefied petroleum gas and CNG (compressed natural gas)).

5) Classification of automobiles based on **:** Body (size)
   a. Sedan with two doors
   b. Sedan with four doors
   c. Station wagon
   d. Convertible, jeep, etc.
   e. Van
   f. Special purpose vehicle – ambulance, milk van, water van, petrol/HSD vehicle.

6) Classification of automobiles based on **:** Source of the vehicle

a. Individual Owner – ELVs are generated by individual owners/users who are generally motivated to sell their ELVs to scrap dealers or hawkers or their agents who provide money in exchange for the vehicle.

b. Commercial ELVs or the fleet owners – The bulk or fleet owners, both the government and private sector, generate bulk ELVs comprising large volumes; these are usually disposed through auctions.

c. Manufacturing defects – Original automobile Manufacturers (OEMs) sometimes produce defective vehicles that do not pass through the Quality Control checks. Some other times the defects are detected after sales and certain batches of vehicles are called back that may be defective. In both cases the manufacturer takes the responsibility and these are either rectified and returned to the customer or sold at discounted rates or scrapped to salvage the useful parts and components.

i. Manufacturing rejects – Huge quantities of rejects arise from the automobile manufacturing which may be whole or in parts. Such parts may sometimes enter the secondary market. At other times they are treated as waste to be scrapped. Both scrap and rejects comprising defective parts or components from the manufacture of automobiles may also be put back into the manufacturing process or channeled for recycling or reuse in an authorized or registered recycling unit.

ii. Second Hand Market – Large number of ELVs are sold to the second hand market where the parts are salvaged and sold to the repair shops and further rejects from these markets are sold as scrap to scrap dealers or recyclers.

iii. Imports – The vehicles imported by consumers for their use, upon reaching the end of life are also major source of spares that are often sold to repair shops or dealers. However, no imports of ELVs are to be allowed for scrapping or recycling.

7) Classification of automobiles based on **:** *Condition of the vehicle* (ASM Auto Recycling 2015)

a. Natural ELVs are vehicles that have come to the end of their life due to natural wear and tear. Natural ELVs are usually more than ten years old. Natural ELVs are mostly depolluted and then dismantled and recycled for scrap metal.

b. Premature ELVs are vehicles that have come to the end of their life for unnatural reasons (e.g. accident, fire, flood or vandalism damage). They are subject to the assessment by the insurance companies and approved to be sold complete as damagedrepairable salvage, or for parts dismantling only.

3.2 Dominance of semi-formal sector

1. In particular the semi-formal sector has a historic role in waste management and recycling in India, that includes recycling ELVs which has existed ever since automobiles were introduced in the country.. Scrap dealers and dismantlers located in major cities carry out the majority of recycling activities. Some of these hubs are well known, for example Mayapuri in Delhi, Pudupet in Chennai, Ukkadam in Coimbatore, Mallick Bazaar in Kolkata and Lohar Chawl in Mumbai.

2. The semi-formal recycling of ELVs in India is characterized by both strengths and weaknesses. On the one hand, the existing system holds benefits w.r.t. creation of employment for thousands in adding of value to materials that would otherwise be thrown away. On the other hand, there are several issues related to the inefficient and harmful processing of ELVs that generate substantial environmental costs that are generally borne by society. Promoting available strengths and working against weaknesses of the ELV sector will contribute to a greater success of the proposed ELV policy framework. (Refer CPCB's report '*Analyses of the ELV sector in India'*)

3.3 Strengths & Opportunities of the ELV sector

a) <u>Employment creation:</u> The semi-formal automobile recycling sector provides jobs to thousands. Many of the prevailing family business are led by young, second generation owners who are well aware of the nuances of reuse and trading on the second hand markets. These entrepreneurs have active and widespread networks, good access to materials and considerable manual skills. For many units, this semi-formal but entrepreneurial SME-based ecosystem permits profitable business operations. Virtually every ELV business surveyed in FY 2014 / 2015 were financially sustainable.

b) <u>Adding value to secondary materials through recycling and reuse</u>

i. In view of the increasing material consumption and increasing prices of raw materials such as steel, copper, aluminum and others, ELVs are considered a valuable resource for recovering them. Efficient and effective recycling of ELVs is therefore a key task to recover the maximum amount from ELVs.

ii. Most of India's semi-formal automobile scrap dealers and recyclers are involved in <u>collection,</u> <u>dismantling</u> <u>and</u> <u>segregation</u> of material. Key parts of the vehicles are identified and dismantled to be sold to those who make best use of these parts. Some parts such as engines, gears and some other intact parts have high value while the others like wheel rims and doors etc., have low value. A large second hand market for the automobile spares is a thriving business with low levels of required capital investment. Salvaging parts for reuse conserves natural resources and energy.

iii. Other materials are recycled using specialized treatment technologies and then sold to specialized traders. The recycling technology for both ferrous and non-ferrous metals, plastics and glass are known in Indian recycling hubs. There are adequate industries set up both for processing such wastes from ELV waste stream.

iv. The economics of reusing and recycling and the social bondage between recyclers are some of the factors that keep the semi-formal sector going.

c) Automotive Industry Standards (AIS 129) for ELVs

Additionally, the Indian automotive industry has set up mandatory Automotive Industry Standards (AIS 129) for ELVs The AIS 129 provide detailed information on various important aspects of the ESM of ELVS.

i. In the first part, they determine the responsibilities of the last owners of ELVs well as of the authorized ELV collection and dismantling centres; describe the procedure for obtaining authorization; and define minimum technical requirements for collection and dismantling centres.

ii. In the second part, the AIS 129 address the vehicle manufacturers. More specifically, they provide a list of materials that should not be used in vehicles; specify which type of information vehicle manufacturers should make available to the dismantling centres; set targets for the minimum reuse and recycling or reuse and recovery rates of vehicles; and make provisions for the type approval of vehicles with regard to their reusability, recyclability and recoverability.

These standards are an important contribution to the ESM of ELVs in India.

3.4 Weaknesses and Threats of the ELV sector

a) Negative impacts in ELV recycling – environmental & health

i. Despite the benefits of recycling and reusing, many of the processes employed in the industry have negative impacts on the environment and on the health of workers and communities.

ii. ELVs contain a number of substances in liquid form (waste oil, engine oil, gear oil, transmission fluid, hydraulic fluid, brake fluid, power steering fluid, etc.) as well as solid form (air filter contains foam and ferrous parts , battery & battery terminal contains acid and lead metals, catalyst spent, cables, tires, plastic parts, polyurethane, glass, etc.). While some of these substances are not hazardous in nature per se, if recycled in uncontrolled environments, they can cause damage to both the environment and human health.

iii. Some of the waste materials can be handled / disposed off as per the requirements in the prevailing regulations e.g. Waste Rules under E (P) Rules 1986 however there are other hazardous materials that are not regulated. Due to their low economic value they are often dumped on the ground or along the roads or in landfills. There is also no decontamination procedure followed in most of the ELV processing units. As a result the hazardous fluids from the ELVs are spilled and disposed on the ground while handling the ELVs. The whole area in such units is often contaminated with oil, coolants and other fluids from ELVs. Since the recycling hubs are located in the urban periphery they have gradually become a part of the city. Environmental pollution due to uncontrolled management of ELVs can thus affect the health outcomes of the nearby residing communities also Furthermore, certain dismantling and recycling processes produce toxic gases that directly harm the health of the scrap workers.

iv. Overall, ELV recycling hubs are operating mainly without environmental or work safety guidelines in their operations. They are considered as 'low grade industry' with minimal investments and marginal revenue generation.

b) Low recovery efficiency of ELV recycling

i. Another issue of the Indian ELV recycling sector is the low recovery efficiency that is caused by the lack of knowledge / access to specialized system / technologies for the collection, dismantling, shredding and processing of ELVs. These recyclers work with very basic technologies that do not allow for the maximum possible recovery and recycling of materials. As a consequence, valuable secondary resources are disposed off and are not fed back into the economy. The main reason for the lack of appropriate technologies is that the number of vehicles coming in for scrapping does not yet provide a sufficient economic basis to invest in elaborate recycling systems. Overall the Indian recycling sector is characterized by low investments and very rudimentary technologies.

ii. Individuals and enterprises are the main players that engage in ELV recycling, they are usually metal scrap dealers and recyclers who treat with various wastes, besides ELVs, to extract metals and other resources. Although scrap dealers salvage and reuse or recycle ELV parts, there are no automotive recyclers who deal specifically with the recycling of ELVs (light and heavy duty trucks, buses, motorcycles, scooters, auto rickshaws etc.)

c) Lack of appropriate infrastructure to deal with future ELVs (ex. NATRiP)

i. The available statistics estimate that ELVs to be recycled and reused will increase dramatically in the near future. The lack of appropriate infrastructure for managing ELVs leads to inefficiencies resource recovery. The major challenge will be establishing necessary to handle the anticipated ELV volume. ELV recycling facilities would need to be mechanized to handle various sizes and volume. This would require high investments and involvement of the various parties in the 'Shared Responsibility Scheme', including automobile manufacturers, government agencies and car owners.

ii. A model facility (NATRiP) has been set up in Chennai which provides the infrastructure requirements for automobile recycling operations. However, such facilities also need to be integrated with the semi-formal sector in order not to wipe out thousands of jobs. This would be critical for establishing a business case for environment friendly management of ELVs as access to material is a critical constraint for the functioning of formal recycling facilities. Overall, there is urgent need to provide for a specified ELV recycling sector.

d) Different value chains

i. The stakeholders in the automobile value chain include raw material suppliers or components manufacturers, automotive producers as well as other players involved in the distribution and marketing of the automobiles. Furthermore, the service centres provide the interface with the customer. There are no linkages between automobile manufacturers and stakeholders after the sale of the vehicle as there are no regulatory requirements for the manufacturers on the management of end-of-life vehicles (ELVs).

ii. For the ELV sector it is not completely clear where the value chain begins and where it ends. In India, the 'recycling' of a motorised vehicle begins when the final consumer or auto disposer delivers the vehicle to the collection centre for deregistration or scrap yard for disposal. Afterwards, various actors ranging from storage facilities to transportation companies, dismantlers, used parts traders and recyclers pass on the vehicle.

iii. The effect of the above 'co-existence' of different value chains is that ELV recycling is not efficient. On the one hand, manufacturers do not know of the capacities and requirements of semi-formal recyclers. Recently, it has been observed that modern vehicles are not recyclable using conventional technologies. On the other hand, the semi-formal sector actors do not have the access / facilities to sophisticated technologies to handle versions of new / larger automobile.

iv. Even though the automotive value chain and the ELV value chain can be closely interlinked there however exists no platform for communication between automobile manufacturers and stakeholders involved in the management of ELVs in India.

e) Lack of proper ELV policy framework

At present there exists no comprehensive policy or regulation governing the management of ELVs. For example, the de-registration certificate provided by the Regional Transport Office (RTO) is not carried out for all vehicles as most of the vehicles are sold as auto junk to the scrap dealers and recycled in the semi-formal sector or abandoned on the road side after accidents, fire, etc.

f) Automotive Industry Standards (AIS 129) for ELVs

The Indian automotive industry has set up mandatory Automotive Industry Standards (AIS 129) for ELVs that provide information on various important aspects of ESM of ELVS (AIS Committee 2015). However, important challenges remain to be overcome.

i. Even though the automotive industry requires "mandatory compliance" with the AIS 129, no mechanisms exist for ensuring their enforcement. As long as it is not defined what is legally required of ELV recyclers a change in behavior towards more environmentally friendly management of ELVs cannot be expected.

ii. The AIS 129 do not include an 'Extended Producer Responsibility (EPR)' scheme as according to the automotive industry, an EPR is neither feasible (due to the development status of the Indian automotive industry) nor necessary (due to the fact that the market provides sufficient incentives for recycling). However, experiences from many countries with ELV legislation show that such a system is key for ensuring ESM of ELVs by providing financial, technological and organizational support to the ELV recyclers. This point will be further discussed in a separate chapter.

g) In view of the above ELV recycling entrepreneurs presently lack requisite information on ELV management. Low recovery and recycling rates as well as environmental and health impacts lead to costs that are distributed among the society in the form of negative externalities – while the recyclers make economic gains. More efficient and environmentally friendly ELV recycling would therefore be desirable from a social as well as from an economic point of view.

3.5 Need for a regulated & resource efficient ELV sector

a) One key requirement is to increase the efficiency of material recovery and recycling of ELVs, this would not only reduce pressure on primary resources (mining activities) but also enhance the economic value of the ELV recycling sector. Besides ensuring the maximum recovery of resources from ELV, it should also be the objective of any comprehensive ELV system to reduce the adverse environmental impacts from ELV handling.

b) "Environmentally Sound Management" (ESM) can be an approach to improve the performance of the ELV sector. ESM means taking all practical steps to ensure that any industrial process or activity is managed in a manner which will protect human health and the environment against the adverse effects which may result from such activities (Basel Convention 2015). “Environmentally Sound Technologies” (EST) can be a means to implement an ESM system. EST refers to technologies used for any industrial process or recycling technologies that are non-polluting and ensure conservation of resources and energy, thereby reducing the waste destined for disposal.

c) If a future system does not integrate the semi-formal ELV recycling sector in a convincing way, negative social effects could be the consequence. In addition, a competition for ELVs between the formal and the semiformal sector could threaten the business continuity of both sectors. The involvement and recognition of the semi-formal sector could be a part of the Corporate Social Responsibility of the automobile and the component manufacturers.

d) However, these changes are unlikely to be proactively implemented by the semi-formal sector without any guidance or regulation. In the following chapters key procedures of ESM will be described and a draft of such an enabling framework will be elaborated stipulating the responsibilities of various stakeholders for the ESM of vehicles throughout their life cycles.

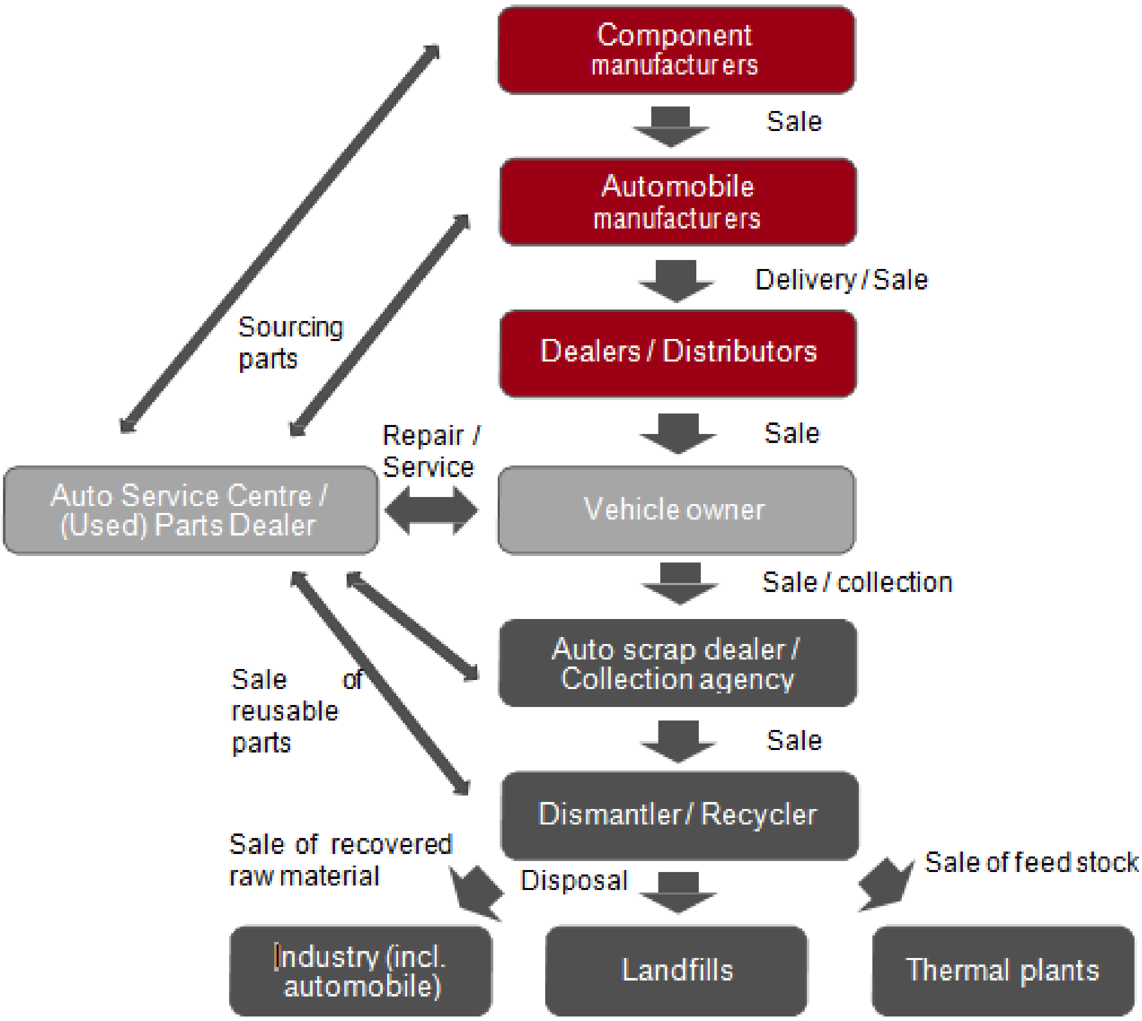

Figure 3.1 Automotive and ELV value chain

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Chapter 4

Existing Policy framework on ELVs in India

4.1 Vehicle policy: registration / de-registration of vehicles

1. The Central Motor Vehicles Act 1988. the rules published there under and the notifications issued provide the regulatory regime for the registration of vehicles. The cancellation of the registration or de-registration of vehicles is the only legal procedure to take the vehicles off the road. This certification is provided by the Regional Transport Office (RTO) which is responsible to register the vehicles that are put on road, and to 'de-register' vehicles that are unfit to ply on road.
2. However, if the ELV is located at within the jurisdiction of an RTO where it was not registered, the ELV would have to be then transported back for de-registration to that RTO where it was registered. This causes undue delay for the businesses that propose to engage in ELV management.
3. To resolve the matter a system needs to establish empowering the RTOs to de-register all ELVs in their jurisdiction and communicate the same to the RTO where the vehicle was originally registered. This amendment would improve the vehicle de-registration process which is currently not very effective in India as the scrap dealers accept ELVs without any legal documentation. Computerization vastly improves communication on registration / de-registration of vehicles.

4.2 Environmental policy – sustainable development includes waste management

1. The National Environmental Policy 2006 (NEP) focuses on sustainable development and the need to facilitate the reuse / recovery/ recycling of necessary material (resourceful) from waste, thereby contributing to the conservation of natural resources and the reduction of wastes destined for final disposal.
2. Eventually environmentally sound management (ESM) of all wastes needs to be ensured. NEP encourages legal recognition and strengthening of the informal waste sectors to be integrated into the mainstream waste management activities.
3. Considering the large recycle potential of ELVs, these should be recycled properly to recover valuable natural resources in an environmentally sound manner. At present there is no separate policy or law or regulation governing the management of ELVs. However, the environmental compliances for recycling activities could be in accordance with the prevailing laws such as The Water (Prevention & Control of Pollution) Act, 1974, (The Water Act), The Air (Prevention and Control of Pollution) Act, 1981 (Air Act) and the Environment (Protection) Act, 1986 (EP Act) and the rules made there-under.

4.3 Rules under E (P) Act 1986 having relevant provisions for regulatory framework applicable for ELVs

1. The Ministry of Environment and Forests has the power to make rules under the Environment (Protection) Act, 1986 which are central regulations implemented through the State Government and State Pollution Control Boards or the Pollution Control Committees of the Union Territories. The following waste regulations (Amended) notified by the Ministry are applicable for the management and recycling of ELVs:

   a) The Hazardous Wastes (Management and Handling) Rules 1989 amended 2008 amended in 2016
   b) The Municipal Solid Waste (Management and Handling) Rules, 2000 amended in 2016 as Solid Waste Rules
   c) The Ozone Depleting Substances (Regulation and Control) Rules, 2000.
   d) The Batteries (Management and Handling) Rules, 2001.
   e) The e-waste (Management and Handling) Rules 2011 amended in 2016
   f) The Plastic Waste (Management and Handling) Rules, 2011 amended in 2016

   All the above rules address environmental issues concerning waste management (recycling or disposal). The different rules cover industrial wastes, urban waste as well as post- consumer waste. These rules have been notified under the Environment (Protection) Act, 1986 by the MoEF&CC in order to provide statutory provisions for regulating the handling and management of wastes without causing any adverse effects on environment and human health.
2. The concept of recyclability of wastes and regulating recycling activity has been introduced in some of these rules with the goal to increase the recovery of resources thereby reducing the waste destined for disposal. Some of these rules include provision for the registration of recyclers which have the capability to recycle wastes using environmentally sound technologies (ESTs).
3. The **Hazardous Wastes (Management and Handling) Rules** 1989 amended 2008 amended in 2016 were the first set of rules that were notified for regulating the hazardous wastes generated from industries. These have been amended in the past and became the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008. The hazardous substances and hazardous fluids present in ELVs such as waste oil, transmission fluid, coolant fluid, brake fluid, power steering fluid, hydraulic fluid, gear oil and other materials arising from de-pollution shall be recycled or disposed of in accordance with these rules. In addition to these substances, the hazardous solid wastes such as air filter, oil filter, brake shoe, asbestos in clutch discs are required to be disposed of in

accordance with the hazardous waste rules. Any recycling of these hazardous wastes recovered from the ELVs shall be carried out only by the registered recyclers notified under these rules. The residues containing hazardous substances arising from both manufacturing and recycling activities have to be disposed of in an environmentally sound manner and the disposal procedures shall be decided on the basis of the constituents present in the waste. All hazardous wastes generated from the ELVs shall be disposed of in accordance with the requirements under the Hazardous Wastes (Management, Handling and Trans-boundary Movement) Rules, 2008.

4. `In compliance with the requirements under the Montreal Protocol the **Ozone Depleting Substances (Regulation and Control) Rules, 2000** have been notified. These rules provide a control on the production, consumption, export and import of the 95 Ozone Depleting Substances listed in the Schedule 1 of these rules. All refrigerants containing ODS recovered from ELVs should be disposed off in accordance with these rules.
5. The lead acid batteries recovered from the ELVs shall be recycled by the registered recyclers in accordance with the **Batteries (Management and Handling) Rules, 2001**.
6. Similarly all electronic gadgets are to be treated and disposed of in accordance with the **E-waste (Management and Handling) Rules in 2011 amended in 2016** to channel e-waste for recycling to registered recyclers. However there are no specific rules for the management and recycling or disposal of some of the parts such as tires, air bags, glass, polyurethane and plastic parts that may be recycled and disposed as is being practiced in other countries. Regulation on ELVs, being a post-consumer waste may be framed on similar lines of the E-waste (Management and Handling) Rules.

4.4 Industry standard: Automotive Industry Standards (AIS: 129) on ELVs

The Automotive Research Association of India (ARAI) along with the Society for Indian Automobile Association (SIAM) and the Automotive Industry Standards Committee (AISC) under the Ministry of Road Transport & Highways have developed ‘Automotive Industry Standards (AIS) : AIS 129 addresses End-of-Life Vehicles’ (ELVs) which were notified in July 2015 by MoRTH. The main objective was to enable automobile recycling to become an organized sector activity and to prescribe minimal operational standards for automobile recycling in-line with the European Directives of 2000 and 2005. In due course of time when large infrastructures are set up for ELV recycling the legal provisions could be developed based on these standards yet going beyond them especially in terms of establishing a ‘Shared Responsibility’ system and providing clear guidance for ESM.

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Chapter 5

Building blocks for a policy framework for India

5.1 Declaration of ELV & De-registration of vehicle

1. Testing , certification of roadworthiness and identification of ELVs
   Testing and certifying the roadworthiness is important to legally assure the roadworthiness of the vehicle by the Regional Transport Office (RTO). The safety, technical performance and emission conformity need to be checked and certified over the vehicle's life cycle i.e. every two years by an independent organization. Once a vehicle is found to be unfit for the road and the owner is not going to repair or upgrade it, then it has to be de-registered by the RTO where the vehicle is presently located. The final decision about declaring a vehicle as ELV should be taken by the last owner of the vehicle.
2. Handing in of the ELV by its last owner
   According to AIS PART-1 para. 4.1 the last owner of an ELV has the following responsibilities:
   a) 4.1.1 The last owner, when he/she considers disposition of vehicle, shall hand over the end-of-life vehicle only to the Authorized Collection and Dismantling centre or his authorized agent.
   b) 4.1.2 The last owner shall ensure that the ELV does not contain any other waste other than an ELV.
   c) 4.1.3 Except as provided for in clause 4.2.2 (c), the last owner shall ensure that the ELV contains the following vehicle aggregates while submitting ELV to the Collection and Dismantling Centre:
   d) 4.1.3.1 In the case of M1 category vehicles: i) Body shell / Chassis ii) Engine Transmission iv) Front and rear axles with wheels and tyres v) Battery vi) Catalytic convertor (if fitted)
   e) Para 4.1.3.2 In the case of L1 and L2 category vehicles: i) Engine ii) Transmission Front and rear axles with wheels and tyres
   f) Para 4.1.4 The last owner shall make an application in Form 3 prescribed in Annex B while submitting the vehicle as an ELV to the concerned authorized collection and dismantling centre.
3. Acceptance by the collection or dismantling facility
   According to AIS PART-1 para. 4.2: any person(s) operating Collection Centre(s) and Dismantling Centre(s):
   Para 4.2.2 a) shall offer the last owner a price, as stipulated by the Government of India from time to time or in absence of such stipulation shall offer the last owner a mutually agreed price based on the evaluation of ELV. In any case collection and dismantling centre shall not charge any money from the last owner.
   i. shall accept vehicle even when some of the parts fitted are not OE parts, but are from replacement market.
   ii. shall accept vehicles retrofitted with CNG/LPG/Hybrid kits, provided the same is endorsed in the registering certificate. AIS-129

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iii. shall accept the accident vehicles irrespective of the state of vehicle, provided that such vehicle is in continued legal possession of the last owner.

iv. shall accept prototype/ research vehicle/ unregistered vehicles.

4. Issuing the Certificate of Destruction (CoD)
   According to AIS PART-1 para. 4.2 any person(s) operating Collection Centre(s) and Dismantling Centre(s) shall issue "Certificate of Destruction" of ELV in Form 4 as per Annex B to the last owner, on receipt of the ELV. Maintain records of the same and the records should be available for scrutiny by the appropriate authority.
5. De-registration
   The first step towards the declaration of a vehicle as ELV is to cancel the registration and provide a destruction certificate to the vehicle owner. According to Section 55 of the Motor Vehicles Rules 1989 the registration of the motor vehicle is cancelled if the vehicle has been destroyed or has been rendered permanently incapable for use or in a condition that would cause danger to the public or beyond reasonable repair. ELVs may be declared on the basis of age of the vehicle, its condition and roadworthiness which should be periodically examined (usually 2 years) by an independent organization once the vehicle is more than two years old or has been driven over 50,000 km. The declaration of ELV should be on scientific basis to include the technical safety of the vehicle and conformity to the emission standards.
   According to AIS PART-1 para. 4.2.10 any person(s) operating Collection Centre(s) and Dismantling Centre(s) shall apply for de-registration of the ELV in Form 20A as per rule 47a of CMVR, 1989 to the registration authority within a period of one month of issue of Certificate of Destruction to the last owner.

5.2 Collection and handling of ELVs

1) There is the need to develop a collection and channelization mechanism for ELVs from the source of its generation for recycling and recovery in an environmentally sound manner. The ELV collection system needs to be established to facilitate the movement of ELV in a regulated manner from its origin to the final destination for recycling, treatment and disposal. The stages involved in the process include establishing collection channels, setting up ELV collection & deposition facilities, providing financial mechanisms for collection, and organizing handling and storage.
2) Collection channels**:** There exist different collection channels for ELVs. Bulk generators or fleet owners such as public transport and tourist agencies (government and private) or offices (government and private) adopt different modes of disposal of ELVs depending upon the number of vehicles and their conditions. Bulk amounts of ELVs are usually auctioned off by public agencies. The buyer is the highest bidder and

could either be a scrap dealer, auto dismantler or a recycler involved in recycling or resale of automobile parts. The other mechanism that prevails is the replacement of old and used vehicles by new ones through dealers or the manufacturers.

Many automobile companies and bulk generators of ELVs carry out regular sales of used vehicles which are conducted by private agencies. The buyers may be individuals who intend to further use the vehicle or auto scrap dealers or dismantlers. The Original Equipment Manufacturers (OEM) also sell their manufacturing defects (parts) to auto scrap dealers or dismantlers in the semi-formal sector. Sometimes OEMs recall the vehicles with manufacturing defects and rectify the same themselves or may also put the defective components and equipment back into their own system by rectifying these. Individual owners channel ELVs through sale or exchange of old vehicles while buying new ones. In case of accidents and fire there are also cases of vehicles abandoned on the road sides from which parts and components are stolen.

The figure below illustrates the different channels of ELV generation.

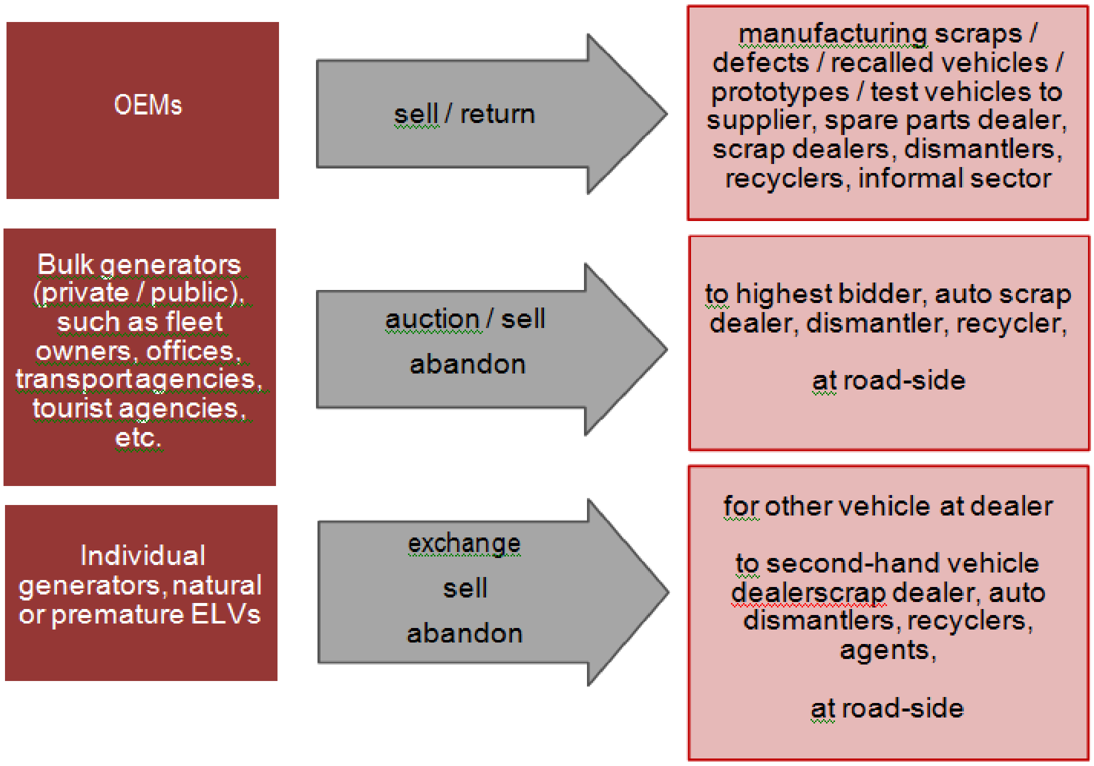

Figure 5.1: Channelization options for ELVs

Based on these common practices the ELV collection channels should close the gaps in the recycling loop and prevent the loss of potentially valuable material. In order to provide efficient collection systems for ELVs, the actors in the collection channels are to assess the materials for reuse and recycling in order to prevent improper recycling practices in the backyard recycling units. Effective collection channels would further enhance the availability of material for recycling and make the tracking of material and material components possible.

5.3 ELV collection & dismantling centres

1) In view of the large size and volume of automobile scrap the collection facility needs to be set up in large areas where the various types of ELVs could be handled. ELVs in India would include the small two and three wheelers, cars, large buses, trucks and trailers. Depending upon the area available, different locations to be assigned for different types of ELVs. At present there is no enforceable requirement for collection of ELVs which could address the process of setting up a nationwide ELV recycling system effectively.
2) Possibilities for take back to be provided by Collection and Dismantling Centres. These could be created by upgrading existing vehicle service centres, scrap yards or recycling workshops in co-operation with vehicle producers. In a collective system, producers would setup joint collection centres or collectively sign contracts with existing recyclers to organize the collection on their behalf. In an individual collection each producer would have to set up his / her own collection facility or sign individual contracts with collectors.
3) Generally, the collection system needs to fulfill the criteria of an adequate area of coverage for collection. It is advisable to consider a 50 km radius around a take back facility. Collection points or centres can be established in designated places where ELVs are collected. Such collection points could also be linked to a centralized collection centre where these could be stored and later sent to dismantling/recycling plants.
4) Roadside dumped vehicles shall be impounded by Municipality after a notice period. No action by the owner will lead to transfer of vehicle by ULB to collection/dismantling facility and also attract a penalty.

5.4 Financial mechanisms for collection of ELVs

As mentioned earlier, AIS PART-1 para 4.2.2 suggests that Collection and Dismantling Centres shall take back ELVs for free or pay the last owner a price. An exception to this might be that if vehicles lack essential components or contain only waste the facility that takes the vehicle back could be allowed to charge the last holder.

In the case that recycling costs generally exceed the financial gains even though the ELVs contain all essential parts, producers could be made responsible to pay for the recycling.

Collective systems often go hand in hand with a deposit that the first owner of a vehicle provides as collateral when he or she purchases a car. This money is paid out when the vehicle is returned to a certified treatment facility at the end of its use life. The other alternative is a fund system that requires either the first owner or producer to pay a certain amount to a fund. The money is not necessarily committed to vehicle return, but could also be used to finance other recycling projects or is sunk in government budgets without any direct environmental designation.

5.5 Handling, storage and transportation of ELVs

1) Handling : ELVs are often large in size (for example trucks and buses) and require machines to handle them. Any vehicle that reaches end-of-life needs to be lifted using cranes and towed to the destination. At the Collection and Dismantling Centres facilities cranes / lifting equipment would be required to move ELVs within the unit. Adequate handling equipment should be required for any ELV collection, treatment and recycling facility.
   In accordance with AIS PART-1 para. 4.2.5 any person(s) operating Collection Centre(s) and Dismantling Centre(s) shall store the ELV (even temporarily) and treat in accordance with Annex A without endangering human health and without using processes or methods which could harm environment. ELVs should be stored in a way that protects their value and protects the surrounding environment. ELVs contain hazardous fluids and other components that can pollute the soil, water, and air. For example, when leaking fluids soak into the ground they contaminate the upper soil layers as well as the underlying groundwater. Likewise, storm water runoff from rainfall and snowmelt can be contaminated if it comes in contact with greasy, oily parts, or flows over contaminated soils or through puddles of vehicle fluids. Contaminated storm water runoff can spread pollution on one’s property and onto neighbors’ property. If refrigerants (such as Freon) are allowed to escape from air conditioning units in ELVs, they can spread to the upper atmosphere and destroy parts of the earth's protective ozone layer. In addition to storing ELVs in an environmentally protective manner, there are good reasons to also store these vehicles in an orderly, tidy manner. Organizing the vehicle storage area helps to keep track of one’s inventory and thus to find a desired vehicle faster. Moreover, leaks and other potential problems can be detected and dealt with more rapidly. (N.H. Green Yards BMP 2008).

2) Storage : Pre-conditions for storing ELVs
   a) ELVs shall not be stored until the fuel, oil, antifreeze, and other fluids are completely drained, and the fuel tank, radiator, and other fluid containing parts have been removed. (Ensure that fluids do not leak or drip onto the ground.)
   b) A written record shall be kept of the vehicles stored.
   c) In order to prepare vehicles for storage a routine shall be established; this helps in knowing the condition of every vehicle stored.

3) An ELV shall not be stored without removing the battery, additional salient points on storage of ELVs :

i. ELVs shall be stored in dry areas where there is no water logging or water will not be flowing under the vehicle during rain or snow melt periods.
ii. ELVs shall be stored on impermeable surfaces, such as concrete or other feasible ground sealing.
iii. Storage areas shall be provided for spillage collection, decanting and degreasing;
iv. Storage facilities shall be provided for dismantled spare parts, including impermeable storage for oil contaminated spare parts;
v. Appropriate containers shall be provided for storage of batteries (irrespective of whether electrolyte neutralisation is conducted on site or elsewhere), filters and PCB / PCT-containing condensers;
vi. Storage tanks shall be provided for the segregated storage of ELV fluids;
vii. Equipment shall be provided for the treatment of water, including rainwater in compliance with health and environmental regulations;
viii. Used tyres shall be stored appropriately, including the prevention of fire hazards and excessive stockpiling.
ix. If engines or greasy parts are exposed, they shall be covered with a tarpaulin or other covering to prevent rain.
x. ELVs shall not be stored in the flood hazard zone or in wetlands.
xi. ELVs shall not be stored along or over property boundaries, public rights-of-way, or easements.
xii. Authorization needs to be obtained from the concerned authorities for the storage of junk vehicles
xiii. The boundaries of the vehicle storage area shall be demarcated with a site drawing.
xiv. Vandals and other unauthorized persons shall be kept from entering the vehicle storage area. If necessary, a fence shall be erected and "no trespassing" signs shall be posted.
xv. ELVS shall be parked in rows, with enough aisle space between the rows to allow individual vehicles to be inspected and removed as needed.
xvi. ELVs shall be stored in an upright position and shall not be stacked or piled on top of each other.
xvii. An inventory of the ELVs shall be stored with detailed record of the make, model, and year of each vehicle, the date the vehicle arrived. The record shall be maintained on date of inspection for leaks, and any other relevant information needed to control the flow of the inventory.
xviii. ELVs that no longer have parts of value shall not be accumulated. They shall be crushed and sent to a scrap processor for material recovery as soon as possible.
xix. The storage area shall be inspected regularly to ensure that there are no problems; a record shall be kept of the inspections.

4) The sites for ELV treatment and storage shall be designated and need to be prepared both for storage and treatment. These areas shall be provided with the following:

   a. Impermeable surfaces for designated areas;
   b. Spillage collection facilities;
   c. Decanters and cleanser degreasers;
   d. Equipment for the treatment of water, including rainwater;
   e. Designated storage areas for dismantled spare parts;
   f. Impermeable storage areas for oil contaminated spare parts.
   g. Tanks/containers for segregated storage of fluids – such as fuel, motor oil, gearbox oil, transmission oil, Hydraulic fluid, cooling liquids, antifreeze, brake fluids, air conditioning fluids and other fluids.
   h. Equipment and tanks/cylinders for safe de gassing and storage of gases and safe storage for pyrotechnics from air bags, ACs etc.
   i. Appropriate Areas / containers for storage of solids , batteries, oil filters Unless crushed, PCB/PCT containing condensers, other hazardous components used tyres (prevent fire hazard due to excessive stockpiling)

5) Transportation of ELVs need specialized vehicles with a provision to lift and load the ELVs. If there are large numbers of ELVs it becomes economical to have dedicated vehicles for transportation. In case of small numbers it may be feasible to use public carriers. Large vehicles and lifts are also required for the onsite movement of ELVs.

5.6 Environmentally sound de-pollution of ELVs

1) According to AIS PART-1 para. 4.2.6 any person(s) operating Collection Centre(s) and Dismantling Centre(s) shall carry out operations for de-pollution of end-of-life vehicles as mentioned in Annex A as soon as possible.
2) The processes involved in de-pollution of the vehicle are important as the ELV is made free from the liquid and hazardous substances and the further processing becomes safe. De-pollution activities should be carried out using appropriate equipment that is specifically designed for carrying out the required de-pollution operations. Most of it is used in automobile service centres and workshops and is commercially available. Such equipment is usually pneumatically operated. The use of such equipment ensures that a high level of de-pollution (removal, as far as reasonably practicable, of most fluids contained in the ELV) can be achieved in a relatively short timeframe (20-30 minutes per ELV). In case that a de-pollution in a completely mechanized system is not possible alternative methods of manual operations could be used, ensuring the same levels of de-pollution without compromising on health and safety requirements. Since the Indian semi-formal sector is

based in manual operations an assessment of the risks involved in using such methods of de-pollution must be carried out. Based on this assessment adequate measures, necessary to comply with relevant health and safety legislation/ regulation, must be put in place. If alternative methods are used it should ensure the same level of de-pollution.

The de-pollution or decontamination operations comprise of a number of steps according to which the ELVs are to be treated (see figure 5.2). The steps are based on the materials contained in the ELV. There are certain minimum standard practices that need to be followed. Additionally, vehicle specific requirements are given by automobile manufacturers.

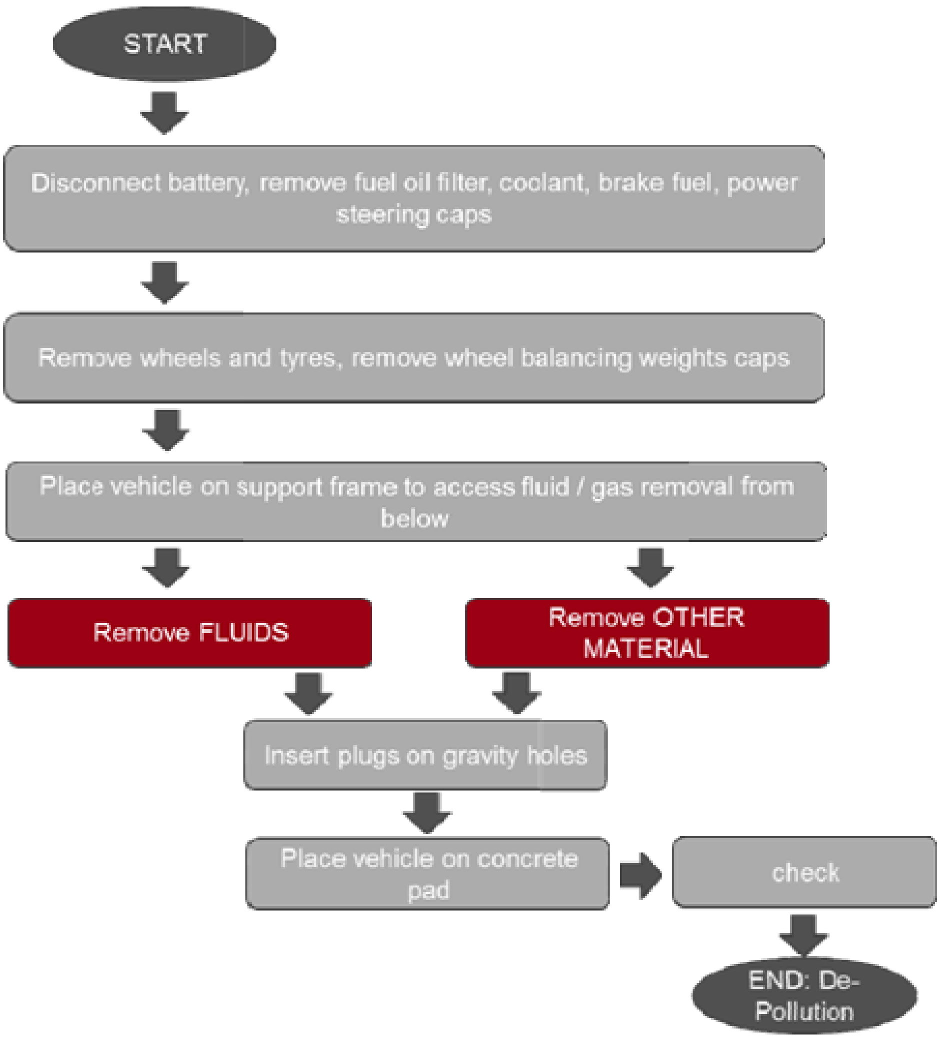

Figure 5.2: De-pollution process

3) The sequence of the operations is given in the table below where it is also indicated whether an individual operation is best conducted from above (A) or below (B) the ELV. The specific sequence of operations, however, may be

evolved as per the requirement of the ELV and equipment available at the treatment facility. The objective should be to completely de-pollute / De-contaminate the ELV before it can be passed on to further treatment, i.e. shredding and material recovery. At least 20 minutes should be given for gravity draining of the engine oil.

Table 5.1: De-pollution sequence (UK DEFRA 2011)

Operation	**De-pollution Sequence**
A. Before Lifting the vehicle	
Remove Battery	A
Remove fuel filter cap & oil filler	A
Set heater to maximum	A
Remove wheels and tyres and separate balance weights	A
Remove any parts identified as containing mercury	A
B. Lift the vehicle on de-pollution frame or lifting device	
Degas air conditioning unit (if fitted)	A
Drain engine oil and remove oil filter for crushing or disposal	B
Drain transmission oil, including rear differential	B
Drain coolant	B
Drain brake fluid	B
Remove catalyst (if fitted)	B
Drain washer bottle	A
Drain brake/clutch reservoir(s)	A
Drain power steering reservoir (if fitted)	A
Drain fuel tank	B
Drain shock absorbers or remove suspension fluid	B
Replace drain plugs/fit plastic stoppers	B
C. Remove vehicle from de-pollution frame or lifting device	
Deploy airbags and other pyrotechnics in-situ (if fitted and able to conduct this operation)	A
Remove air bags and other pyrotechnics (if fitted, and cannot be deployed in-situ)	A

For the removal of hazardous substances certain rules have to be complied with. Some of the basic steps have been given below based on the common hazardous materials that are likely to be present in all vehicles

4) Hazardous substances (fluids)

Hazardous substances (fluids) such as engine oil, gear oil, transmission fluid, hydraulic fluid, brake fluid, power steering fluid, coolant fluid, present automobiles need to be de-contaminated while processing ELVs as per the norms prescribed in the relevant regulations and guidelines.

a. Waste oils
   i. Used and waste oils shall be sent to registered recycling or re-refining unit.
   ii. If uncontaminated, these shall be sent for burning for energy recovery.

b. Transmission oil
   i. Transmission oil contained in gearboxes can be gravity drained through the drain plug. Drilling a hole in the bottom of the gearbox shall drain those without drain plug.
   ii. In rear axle differentials of rear wheel drive vehicles the drain plug shall be drilled or differential flange shall be loosened to allow the oil to drain.
   iii. Oil shall be collected in a container and stored and then sent for disposal.
   iv. The power steering fluid has to be extracted from both reservoir and connecting hose using similar equipment for reservoir and by piercing the hose and sucking out the fluid or cutting.
   v. Transmission oil/fluids shall be managed like used oil by direct reuse or re- refining in registered recycling units, or by burning it for energy recovery.
   vi. Transmission fluid must not be disposed in a storm drain, septic tank, on the ground, the sewer system or dumpster.

c. Brake fluids & cleaners
   i. Brake fluid is typically contaminated with chlorinated solvents from brake cleaners.
   ii. Brake fluid shall be collected in a separate container marked, "Hazardous Waste – Brake Fluid".
   iii. Brake fluid must not be burned for energy recovery.
   iv. Brake fluid must not be disposed of in a storm drain, septic tank, on the ground, sewer system or dumpster.
   v. Brake and carburetor cleaner shall be closed when not in use.
   vi. Brake/carburetor cleaners must not be mixed with other solvents, like solvents from parts washers.
   vii. Spent cleaners and solvents shall be disposed of as hazardous waste.

d. Fuel and fuel filters

i. Fuel shall be removed from fuel tanks by siphoning or suction as soon as the vehicle enters the facility.

ii. Fuel reusability shall be determined – it shall be labeled "Reusable Gas (or Fuel)" if reusable; if the fuel is not reusable it shall be labeled as "Hazardous Waste – Gas (or Fuel)"

iii. All fuel shall be stored in closed, leak proof containers.

iv. Reusable fuel shall be used at the facility or given away.

v. Fuel must not be mixed with any other waste streams.

vi. Excess fuel shall be drained from filters into a proper fuel container.

vii. Used fuel filters shall be kept in a separate fireproof container marked "Hazardous Waste Fuel Filters Only". Fuel filters shall be treated as hazardous waste and disposed of as required. (Florida Department of Environmental Protection 1999)

e. Coolant (Antifreeze)

Coolant can be gravity drained removing the bottom hose from the radiator or using suction and a minimum of 10 litres is collected and reused.

5) **Hazardous substances (solids)**

a. Lead acid batteries present in the automobiles are one of the major sources of toxic and hazardous substances. They contain sulphuric acid that is corrosive and lead plates that are highly toxic.

i. Lead-acid Batteries shall be removed and tested for reusability.

ii. Leaking batteries shall be drained and acid stored in containers safely.

iii. Intact or drained batteries shall be stored indoors avoiding heat and rain.

iv. Batteries shall be sent for recycling in registered recycling units.

v. Battery terminal metal parts sold as scrap for recycling shall contain acid which causes pollution

b. Air filter contains foam and ferrous parts that pose a potential hazard if burnt in case it cannot be directly used.

c. Oil filter contains filter paper and residual oil which is toxic when burnt, it also contains metallic parts which is sold by scrap dealers

d. Hot tank solutions and sludge from cleaning ELVs (and ELV parts) in auto recycling units could be a major issue as it shall be contaminated with the process effluents and residues. These need to be treated as hazardous wastes.

e. Mercury switch shall contain mercury, copper and brass that makes it attractive to recycle.

f. Brake shoe clutch plates/discs contain asbestos that is carcinogenic and hazardous to human health. Asbestos are crushed with the vehicle and are not removed for reuse in vehicle recycling. If brake shoes and clutches are not removed, asbestos particles shall become airborne while shredding. Sometimes these are stripped and dumped on ground The best way is to limit exposure and health damage by providing proper controls to contain brake dust and prevent its release in the air:

i. Brakes or clutches must not be cleaned with air hoses, dry brushes, wet brushes, rags, garden hose, liquid squirt bottles, solvent spray or ordinary shop vacuums.
ii. Brake shoes or clutches shall be removed using specially designed low pressure spray equipment that wets down brake or clutch dust and properly catches the runoff to help prevent asbestos from being released.
iii. It is not recommended to eat in asbestos work areas. It is recommended to wash hands before eating.
iv. Before going home clean clothes shall be put on. Asbestos particles can become embedded in clothing and carried into the house. (Wyoming Department of Environmental Quality n.d.)

g. Rubber parts are usually sent for recycling in furnaces as they have the potential to emit toxic fumes.
h. Glass parts, essentially the windshield and other glasses fitted in the doors, are toughened glass with a PVC sheet pressed between the two layers of glass. If the glass is intact it can be reused. Recycling options are limited and it can only be recycled into construction aggregate. If the PVC is removed then it can be recycled like normal glass. If recycling automotive glass is not an option, it shall be handled as solid waste.
i. Electronic parts are fitted in modern cars. Such electronic waste shall be disposed of in accordance with the E-waste (M&H) Rules.
j. Refrigerant gases present in ELVs need to be removed before processing ELVs as these have the potential to cause adverse effects on environment and health. The two types of refrigerant that are used in vehicle air conditioning systems are R12 and R134a. The type of refrigerant is marked on the vehicle. The refrigerant must be removed using specialist equipment which allows airtight operations in order to avoid any gas leakage, and two collection cylinders are required; one for R12 (a CFC) and one for R134a (an HFC).
k. Airbags contained in most of the modern vehicles contain explosives and shall be handled in accordance with the handling and deployment procedure prescribed by the manufacturer.
l. Catalyst: All modern vehicles contain catalytic converters in the exhaust for both diesel and petrol vehicles. These catalysts contain precious and rare metals which are valuable for recycling.

5.7 Environmentally sound dismantling & segregation

1) In the next step, the de-polluted and decontaminated ELVs are dismantled to separate different parts of the vehicle into their

components so that these could be segregated for further processing. Dismantling is one of the important steps in the processing of ELVs. The dismantling process could be manual or mechanical depending upon the type and size of the vehicle. Small vehicles can be easily dismantled and manual dismantling is preferred. The larger vehicles that are not easy to handle manually can be dismantled using machines or are subject to mechanical dismantling. Manual dismantling helps to identify and remove parts that can be reused.

2) Some common components of automobiles during recycling are: (Automotive Recyclers Association 2014)
   i. Engines and transmission systems removed from vehicles can often be directly reused; they shall be stored under a permanent roof on an impervious surface, or in an outdoor covered, weather-proof container.
   ii. Engines and transmissions that can be re-manufactured and/or recycled shall be stored under a permanent roof on an impervious surface, or in an outdoor covered, weatherproof container or on an impervious surface that drains to an oil water separator or equivalent treatment device.
3) In line with AIS PART-1 para 4.2.8 any person(s) operating Collection Centre(s) and Dismantling Centre(s) shall not sell the components mentioned in clause 4.2.8.1 and 4.2.8.2 below to any person(s) for reuse in the after sales market and shall dispose of in an environmentally friendly manner.
   i. Para 4.2.8.1 In the case of M1 category vehicles: i) all airbags including cushions, pyrotechnic actuators, electronic control units and sensors ii) automatic or non- automatic seat belt assemblies, including webbings, buckles, retractors, pyrotechnic actuators iii) seats (only in case where safety belt anchorage and / or airbags are incorporated in the seat) iv) steering lock assemblies acting on the steering column v) immobilizers, including transponders and electronic control units vi) emission after treatment systems (e.g. catalytic converters, particulate filters) vii) keys and lock components viii) sections of bodywork bearing the vehicle identification number ix) electronic brake components. AIS-129 4/48
   ii. Para 4.2.8.2 In the case of L1 and L2 category vehicles: i) Steering lock assemblies acting on the steering column ii) Immobilizers, including transponders and electronic control units iii) Emission after treatment systems (e.g. catalytic convertor, particulate filters) iv) Keys and lock components v) Sections of bodywork bearing the vehicle identification number vi) Engine parts bearing the engine number vii) Electronic brake components viii) Suspension system ix) Any item other than those recommended for reuse by the vehicle manufacturer in the dismantling information.

5.8 Environmentally sound Shredding & separation and processing residues

1) When an ELV is shredded, the residue is usually separated into four fractions: ferrous metals (using magnetic separation), non-ferrous metals (using mechanical separation), heavy shredder residue and the light fraction, which is separated by air suction. Ferrous metals are not being processed further, and are considered ready.
2) After dismantling and recovering parts from the ELV, the remaining part is known as car hulk. This hulk is compressed and flattened and sent to a shredder for scrap metal recovery. The shredder essentially pulverizes the vehicle into fine sized pieces of materials, which are then sent by conveyors for separation using magnetic separation, eddy current, laser and infrared systems (depending on the availability of the systems). Shredding and separation plants are capital intensive and technically complex. The metal recovered from these plants becomes raw material feedstock for steel mills, electric arc furnaces, aluminum and other non-ferrous metal smelters to manufacture a variety of products, including new vehicles (Recycle Guide 2014). The automobile recycling rate is almost 100% and is the most recycled commodity.
3) Along with ELVs, shredders may also process other metal rich scrap, such as construction scrap and waste, large end-of-life appliances such as white goods. During the shredding process, the vehicle is broken down into much smaller pieces, and the metals are extracted. Both ferrous metals – iron and steel – and non-ferrous metals, such as copper, zinc and aluminum, are recovered. Ferrous metals make up about 70% of a vehicle, while non- ferrous metals make up about 6%. These are separated using magnetic separators. The amount of recyclable material that is removed from an ELV via shredding is generally calculated to be about 75% by weight. By far the greatest share (by weight) of recycled material is the scrap metal.
4) Treatment of automobile shredder residue (ASR) : The final processing of ELV by shredding generates many fractions and a residue also known as automobile shredder residue (ASR) containing a variety of materials that could not be recovered by any of the processes employed. This residue has been a major concern in many countries and a lot of research has been going on to assess how this residue could be used. The two fractions identified in ASR are the light fraction representing 10-24% of the weight of the original vehicle and the heavy fraction representing 2-8% of previous vehicle weight. A gross estimate of ASR generated from ELV recycling in relation to the original vehicle weight is 15-17%. Initially ASR was being land filled. Recent findings show that the light fraction of ASR could be used for energy production while only the heavy fraction needs to be land filled. In Japan mixed ASR is used for thermal energy production. Today it is still being debated whether some amount of ASR needs disposal.

The schematic diagram shown below has been presented in an international comparative study on ELV recycling systems (Sakai et al. 2013). It depicts the steps required for a systematic recycling process but also indicates the percentage recovery rates of resources at different stages in the ELV recycling process.

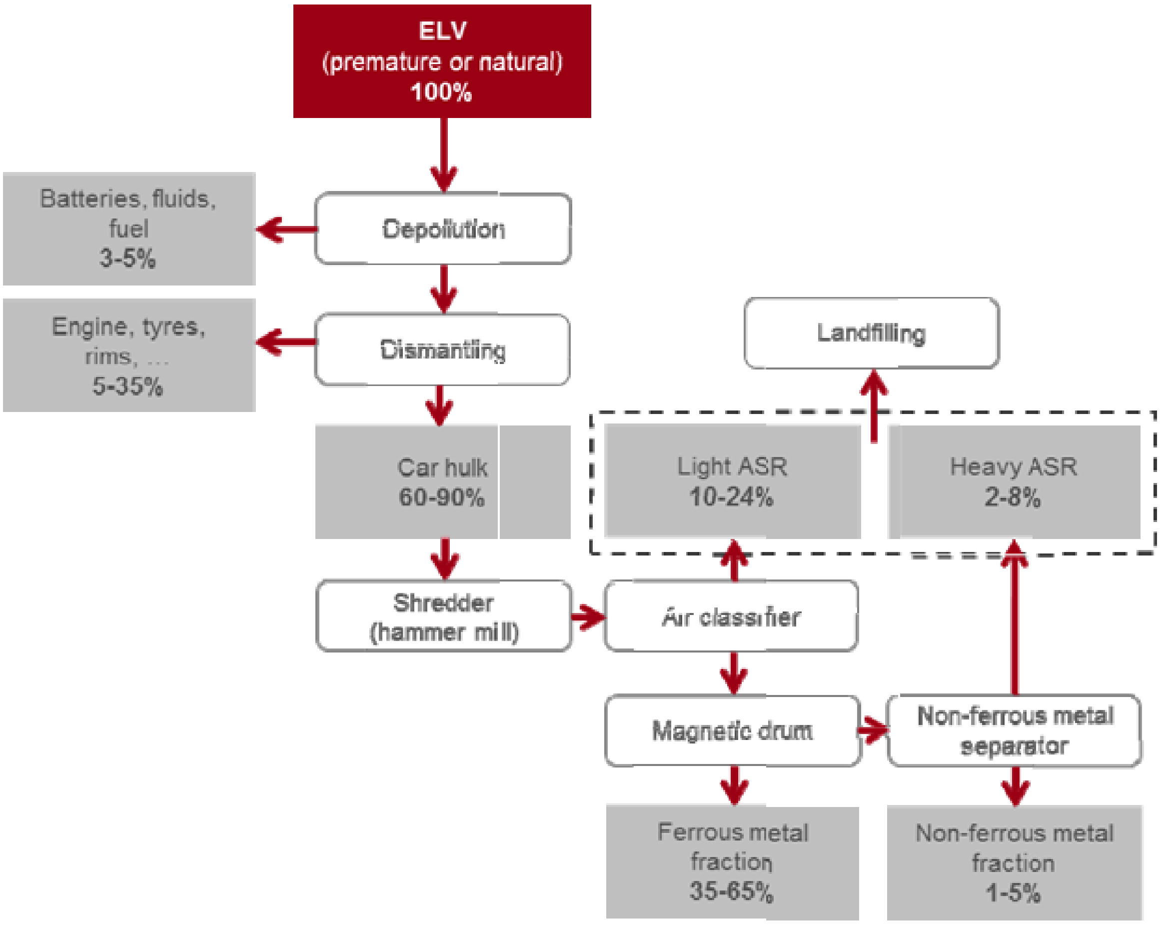

Figure 5.3: Typical ELV processing in the EU (Sakai et al. 2013)

The de-pollution removes 3-5% of weight, dismantling 5-35% of weight, and remaining car hulk is about 60-90% of the previous car weight. The ferrous metal share after shredding is 35-65% while the non-ferrous share is 1-5%. Substantial amounts of non-ferrous parts enter into heavy ASR fraction (2-8%) while the light fraction of ASR is around 10-24%.

5.9 ELV recycling facility

1. The establishment of an ELV recycling facility to be based on the guidelines published, best practices adopted and regulatory requirements in India for establishing and operating "Recycling and Disposal Facilities". Such facilities shall only be set up by the formal, formalized or organized sector. The activities presently taking place in the semi-formal sector need to be integrated. They shall provide a support and channelization system for the integrated facilities that are to be

established. With the increasing vehicular population a suitable infrastructure for large scale operations is needed to deal with a large number of vehicles. This would facilitate semi-formal sector into the main stream of the ELV management activities and ensure environmental compliance. The proposed mechanism for the ELV recycling facility is only an illustrative model and details have to be worked out to develop such facilities.

2. ELV Facility and operation requirements**:** In order to provide an infrastructure for recycling ELVs there is a need to identify large areas of land where adequate space is available for storage, handling, and recycling ELVs. ELVs requiring treatment range from small two wheelers to large trucks and trailers. It may be possible to have different facilities for different types of vehicles but one major facility in every region catering to a number of States would be ideal. However, the interstate movement would need to be streamlined.

3. Procedures for Setting up & Management of ELV recycling facilities

Steps required for setting up ELV recycling facility are the following: (U.S. Environmental Protection Agency n.d.)

i. A license shall be obtained to set up the ELV recycling industry from the appropriate authorities.

ii. Land shall be produced in an Industrial Estate to set up the facility. Requisite layout and design approvals shall be obtained

iii. In accordance with AIS PART-1 para. 4.2.4 any person(s) operating Collection Centre(s) and Dismantling Centre(s) shall fulfill the minimum requirements in accordance with Annex A.

iv. Environmental Clearances (EC) shall be obtained based on the scale of operations as prescribed in the Environmental Clearance notification dated 14 September 2006.

v. An Environmental Management Plan (EMP) shall be prepared and put in place.

vi. Facility shall have obtained consents under the Water Pollution (Control & Prevention) Act, 1974 and Air Pollution (Control & Prevention) Act, 1981.

vii. Facility shall be registered as a Recycler under the Hazardous Wastes (Management, Handling and Trans-boundary) Rules 2008 with the concerned State Pollution Control Board.

viii. Facility shall have a written plan describing the facility's risk management objectives for environmental performance and compliance and its plans for attaining these objectives based on a "plan-do-check-act" continual improvement model.

ix. Regular evaluation of Environment, Health and Safety (EH&S) objectives and monitoring of progress toward achievement of these objectives shall be conducted and documented in the facility.

x. Facilities shall take sufficient measures to safeguard occupational and environmental health and safety. Such measures may be indicated by local, state, national and international regulations, agreements, principles and standards, as well as by industry standards and guidelines.

xi. Training & Capacity Building for employees at different levels.

xii. Environment , Health & Safety (E H & S)

a. An up-to-date, written hazardous materials identification and management plan to address the specific hazardous materials that would be handled.
b. Where materials are shredded or heated, appropriate measures to protect workers, the general public and the environment from hazardous dusts and emissions.
c. An up-to-date, written plan for reporting and responding to exceptional pollutant releases, including emergencies such as accidents, spills, fires, and explosions.
d. Liability insurance for pollutant releases, accidents and other emergencies.
e. Completion of an EH&S audit, preferably by a recognized independent auditor, on an annual basis.

xiii. Facility to have a regularly implemented and documented monitoring and recordkeeping program that tracks key process parameters, compliance with relevant safety procedures, effluents and emissions, and incoming, stored and outgoing materials and wastes.

xiv. Facility to have an adequate plan for closure and shall be updated periodically and financial guarantees shall ensure that the necessary measures are undertaken upon definite cessation of activities to prevent any environmental damage and return the site of operation to a satisfactory state, as required by the applicable laws and regulations.

xv. Finally, as laid out in AIS PART-1 para. 4.2.12 any person(s) operating Collection Centre(s) and Dismantling Centre(s) may accredit their centres/units as per ISO 14001 (Environmental Management System)

4. Registration and authorization of Recyclers processing ELVs

In order to grant recyclers of ELVs a proper legal status they need to become registered according to various regulatory regimes for the recycling of wastes such as non-hazardous and hazardous wastes, lead acid batteries and E-waste. In the beginning of the establishment of an ELV system, registration of recyclers could be introduced in the guidelines as a voluntary measure. After a certain period, registration requirements could be included in the emerging policy framework. Finally after the acceptance of the principle behind the registration by all stakeholders these registration requirements could be mandated through a regulatory framework. Basic requirements to be eligible for recycling ELVs are as follows:

a. The **ELV** recyclers and their facilities shall be registered with the Central Pollution Control Board and/or the respective State Pollution Control Board
b. In Accordance with AIS PART-1 para. 4.2.1 any person(s) operating Collection Centre(s) and Dismantling Centre(s) shall obtain an authorization in accordance with the procedures prescribed in AIS PART-1 para. 5 "Procedure for authorization by Government certifying agency" from the concerned Government Certifying Agency (see Annex B).
c. Only registered and authorized recyclers shall be allowed to recycle ELVs
d. Recycling shall be carried out using environmentally sound technologies
e. The subsequent residue disposal is to be conducted as per the Hazardous Waste Rules 2016
f. Recycling is to be carried out as per this document, *'Guidelines for Environmentally Sound Management of ELVs'*

5.10 Technologies for the ELV recycling process

The technologies required in the recycling process of ELVs are presented below :

a. Technologies for de-pollution, dismantling and segregation
    i. For the lifting of vehicles during the de-pollution process the recycling facility needs a de-pollution frame or lifting device.
    ii. Pneumatic tools and electrical screwdrivers are required for detaching the parts to be recycled from the ELV.

b. Technologies for shredding : Dry / moist shredding: Vehicle hulks are fed to the shredder/hammer mill with varying amounts of water. In case of dry shredding, extensive dust is sucked from the shredder by suction air streams. For moist shredding a small amount of water is sprayed into the shredder to eliminate airborne dust emissions from the shredder and from the product transfer points (Gesing 2006). Most shredders worldwide process ELVs alongside other consumer products including white goods, light iron and metallic manufacturing and construction waste (Forton et al. 2005).

c. Technologies for processing residues - Segregation of light ASR
Air classifiers, cyclone separators: After shredding, all material is injected into a chamber which normally contains a column of rising air. Light ASR, fluff and dust is lifted up by the air drag and removed by cyclone separators. There exist various types of classifiers that can separate particles of different sizes and weight classes. Air classification can be repeated until material is sorted to a satisfactory degree (Christensen 2011).

d. Technologies for processing residues - Segregation of ferrous metal fractions:
Magnetic separators: Once light material has been separated, the

remaining residue is transported to magnet separators / drum magnets for segregation of ferrous metals. Magnetic separation can be repeated until material is sorted to a satisfactory degree. This could be beneficial if, for example, small ferrous particles were covered and held back by other non-ferrous materials during the first magnetic separation process (Forton et al. 2005).

e. Technologies for processing residues - Segregation of non-ferrous metal fractions:
   i. Eddy-current separators (ECS): In the next step, non-ferrous metals (aluminum, copper, zinc, etc.) are separated from non-metal materials using eddy-current separators (ECS). The ECS is installed at the end of a conveyer belt and creates a magnetic field to throw conducting metals forward from the belt into a product bin, while non-metals simply fall off the belt (Mastermag, n.d.). Modern ECS can also eliminate small arts of ferrous metals left from the sorting with magnetic separators (Cogelme, n.d.). The separation process can be repeated until material is sorted to a satisfactory degree.
   ii. Heavy media separation / sink-and-float separation: Another technology for segregation of non-ferrous metals is by heavy media separation, also called sink-and-float separation. Material is introduced into a heavy medium (mixture of water and very fine and dense powder). Denser particles will sink, while lighter particles will float on top of the medium (Encyclopædia Britannica Online). Compared to ECS, wet separation methods have the major disadvantage of having long wait times for settling and drying. Furthermore, they produce large amounts of waste water (Lee 2012).

f. Other technologies

   There exist other technologies for separating metals from specific non-metal materials. For example, polymers can be removed using electrostatic separators (Lee 2012).
   i. Sorting of non-ferrous metal fractions: Sensor-based / manual colour sorting: Non-ferrous metals are then sorted by colour. Sensors based on colour recognition can be applied to differentiate copper and brass (red/yellow particles) from aluminum/ magnesium (white/grey particles). Colour sorting of different non-ferrous metals can also be done by hand (Margarido et al. 2014).
   ii. Sorting of ASR - Air classifiers, cycle separators : Non-metal residues (glass, fibre, rubber, plastics, dirt, etc) can again be separated into light and heavy fractions using air classifiers.

g. Technologies for treatment of segregated materials

   After the shredding and separation process, there are the ferrous metal, non-ferrous metal, and light and heavy ASR fraction. The ferrous and non-ferrous metal fractions are commonly treated in metal smelters. There are different options for treating the ASR fractions.
   i. Thermal treatment: ASR has a calorific value of 14 – 30 MJ/kg

rendering it a valuable energy source. However, high chlorine content, brominated flame retardants, ash content and high heavy metal concentrations make it difficult to actually use it as fuel (UNIDO et al. 2012). In addition, it has varying moisture content (Jody et al. 2010). To limit the amount of hazardous substances released from burning ASR, it may be co- incinerated in Municipal Solid Waste (MSW) incineration plants not exceeding a certain share in the fuel (in Switzerland the ASR fraction may not exceed 5 %, in Sweden up to 20 % were co-incinerated in MSW incinerators). Testing the flue gas emissions showed that the flue gas emission composition did not change significantly. However, concentrations of heavy metals increased in boiler and fly ash (UNIDO et al. 2012).

ii. Another option is to improve the quality of the ASR. By removing the finest fraction of the ASR through screens, shaker tables, rotary drums or float/sink separation techniques the ASR fuel quality can be improved. Removing PVC from the ASR can lower the chlorine concentration of ASR. Density separation with a bath density of 1,100 – 1,200 kg/m^3 can remove up to two-thirds of chlorinated plastics from the ASR (UNIDO et al. 2012).

iii. Although ASR could be used as a fuel for cement kilns, tests using 50 % of ASR as fuel in the kilns had a negative effect on clinker as the concentrations of heavy metals in the material increased significantly. In addition, more ash is formed, clogging of the fuel injection zone happens and increased concentrations of hazardous elements are found in the kiln dust (UNIDO et al. 2012).

h. <u>Metal recovery:</u> For recovering metals from the recycling process, the obtained materials can be treated in different smelters. Ferrous metal junks can be fed into electric arc or blast furnaces (Kumar and Sutherland, 2008). The different metal fractions can be treated in copper or integrated smelters. As integrated smelters are high-tech installations only 5 – 10 smelters fit to adequately and environmentally-sound treat the ELV fractions exist, among them smelters in Belgium, Canada, Germany, Japan and Sweden (UNIDO et al. 2012). Light residues from a car shredder can be treated in secondary aluminum smelters (UNIDO et al. 2012).

i. <u>Chemical recycling :</u> There is the option of converting the organic content of ASR to liquid and gaseous fuels via pyrolysis or gasification (Jody et al. 2010) Through chemical recycling processes, materials such as monomers, lighty hydrocarbons, liquid and gaseous fuels could be extracted from the hydrocarbon- based fraction. The main sources of such products will be plastics and rubber. Processes that may be employed for chemical recycling include most prominently pyrolysis and gasification. Other processes are hydrolysis, selective dissolution, hydrogenation, and de-polymerization (Jody et al. 2010). Pyrolysis is the thermal decomposition of organic materials (such as wood, coal, plastics, tires) to produce fuels and chemicals (Jody et al. 2010). Gasification is a process that converts the organic component of a material in a gaseous mixture of CO, H_2 and CO_2 and reduced metals. Gasification reactors commonly used are moving bed, fluidized bed and entrained flow reactors (Jody et al. 2010).

j. Plastics recovery: Technologies that could be used to separate plastics from the ASR are heavy media separation, froth flotation, jigging, cryogenic grinding, use of magnets, air knives and vibrating tables (Forton et al. 2006). Plastics would have to be separated in different types to be reused (Forton et al. 2006). As the thermoplastics content in the plastics fraction in ASR is rather high (70 – 80 %) it can be recovered, heated and remolded in products such as park benches, lamp posts, road side furniture, etc. Separation technologies that could be used for this task include water elutriators and gravity separators (Jody et al. 2010). Conventional MSW recycling separators could be adjusted for the application to ASR (Jody et al. 2010).

k. Incorporation into other materials : ASR can also be recycled or stored by including it in composite, concrete or asphalt (UNIDO et al. 2012).

l. Land-filling : Land-filling of the ASR is still the most common treatment approach for this fraction as the other technologies described above are either too expensive or have significant negative environmental impacts.

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Chapter 6
Proposed Policy Framework for ELVs in India

6.1 Goals of a Policy on ELVs

The policy goals for the proposed ELV management system are:

a) **Decrease** open dumping of ELVs.
b) **Encourage** re-use, recycling and other forms of recovery of ELVs.
c) **Reduce** the uncontrolled disposal of ELVs by the semi-formal sector.
d) **Control** the usage of Hazardous Substances in new vehicles.
e) **Contribute** to the efficient use of resources and the retrieval of valuable secondary raw materials.
f) **Improve** the environmental performance of all operators involved in the life cycle of ELVs (e.g., manufacturers, importers, distributors, consumers, collectors, dismantlers, recyclers, and exporters).
g) **Set up** a "Shared Responsibility" scheme.
h) **Engage** consumers and businesses - Business-to-business (B2B) and Business-to- consumer (B2C).

6.2 Focus – involvement of key stakeholders

1. At present there is no comprehensive policy or regulation governing the management of ELVs. Some of the regulations applicable to ELVs are discussed in this chapter with suggestions on how to develop a new policy framework for ELVs. In India, the existing national policies and regulations for ELVs include those that deal with the declaration of vehicles as ELV and some steps or elements of the recycling processes of such vehicles.
2. The policy and regulatory framework for ELVs should essentially provide for the declaration, collection, handling, dismantling, recycling and disposal of ELVs as a 'Shared Responsibility' involving the key stakeholders such as manufacturers, dealers, consumers and recyclers. The main objective of the policy should be to address the requirements for ELV management and to put in place an effective control and monitoring mechanism on the declaration, collection, handling, dismantling, recycling and disposal of ELVs. In this regard the consultations with stakeholders in the ELV value chain should lead to a consensus for a regulatory framework to include regulations and procedures for environmentally sound management of ELV. Once a vehicle is declared as ELV there is the need to regulate the handling and processing of ELVs. For this reason a policy framework for ELV management and handling needs to be promulgated in India.
3. In order to accelerate the policy development process, the development of these Guidelines on the Management and Handling of ELV (this document) is a first step towards this goal and can be considered as a precursor to a proper regulatory framework.

4. In the policy framework to be developed, ELV generators should include consumers such as bulk consumers (transport agencies, institutions, banks, public and private undertaking etc.) as well as individuals. It should regulate wastes in the form of rejects, scraps etc., from manufacturing of vehicles as well the fines generated while scrapping. The various types of vehicles should be classified and within each category the components from each vehicle should be listed. Some aspects of the recycling process are already covered under existing rules. The Hazardous Waste Rules cover some of the hazardous constituents from ELV such as the lube and waste oils, cooling fluids, cables, etc.; the lead acid automotive batteries are covered under the Batteries Rules and the e-waste in the electronic gadgets provided in the automobiles is covered under the E-waste Rules.

   The policy should address the following:
   a. Shared Responsibility involving all stakeholders
   b. Mechanism for ELV Declaration, Deregistration, Destruction Certification and Transportation to Authorized Recyclers
   c. Authorization & Registration of Recyclers processing ELV
5. The environmentally sound management of ELVs needs to be the regulated by the Ministry of Environment Forests and Climate Change along the lines of other post-consumer waste streams. The policy process would comprise different stages in the decision making process with a logical sequence for problem solving involving all stakeholders.

6.3 ‘Shared Responsibility’ Scheme

1. A key building block of the proposed framework, not covered under the AIS 129, is the introduction of ‘Extended Producer Responsibility’. As mentioned earlier in this report, EPR is now being used globally as a policy instrument in waste management legislations. However, the concept of EPR would need to be adapted to the Indian conditions to make it viable. Given the vast presence of the semi- formal sector in ELV management, introduction of EPR along the lines of the European experience would not be viable in the Indian context. <u>‘Extended Producer Responsibility’ would have to be embedded within a ‘Shared Responsibility’ Framework</u> with clear roles envisaged for the public sector as well.
2. Such a shared responsibility model would enable the development of appropriate infrastructure through the modality of PPPs. Also, the bridging of formal and semi-formal markets for the handling of ELVs would need active intervention and convening power of the public sector. It is critical that the roles and responsibilities of the different stakeholders in such a shared responsibility model are clearly defined and supported through a legal instrument. This would enable the development of controlled channels for the flow of materials as well as infrastructure to handle the ELVs.

6.4 Regulations on ELVs

From a proposed regulatory perspective the following success factors are critical for the successful management of ELVs:

1. Generally, the regulation adopted for ELVs shall comply with Rule of Law standards, i.e. be precise, coherent, practical and proportionate.
    a. ***Precise*** means that clear legal terminology is used and that especially all rules that impose responsibilities and obligations on private or legal persons or confess rights must be fully understandable.
    b. ***Coherent*** means that all rules are shaped in a way that they fit with already existing rules in other legal acts without contradictions or unnecessary redundancies
    c. ***Practical*** means that the legal provisions adopted can realistically be applied and enforced, either directly after the entry into force of the Regulations or later, as indicated in transition clauses. The most ambitious and advanced legislation is not worth anything if it cannot be implemented due to high demands, complexity, unrealistic targets or low institutional capacity etc.
    d. ***Proportionate*** means that obligations, restrictions, fines, are always in proportion to the goal to be achieved and can be realistically complied with by the addressee of a rule.
2. Command and control mechanisms and instruments such has authorization, registration, record forms, prohibitions, inspections should only be used to the extent necessary from an environmental perspective.
3. However, as regards the future success of an ELV management system to be established that proper awareness raising, information distribution and voluntary participation are at least as important – and they do not need much legislation. This goes even more in a largely self-organized system led by the private sector.
4. The environmental safe treatment of ELV can only be ensured through adequate treatment standards and the authorization or registration of stakeholders involved in any kind of ELV treatment activities.

6.5 Financing - ELV management principles

To create a system that encourages participation of all the relevant stakeholders and to create a level playing field, the fund management should be based on the following critical principles:

a. **Cost recovery**: The ELV management system should be based on a not-for-profit basis and finances should be allocated to recover costs. There should be an annual financial audit of the system that presents the total costs of organizing and implementing the ELV management system. The recycling costs should be suitably adjusted if there is either a build-up or running down of the funds as compared to the costs.

b. **Visibility**: If the burden of the finances required to set up the ELV management system is passed on to the consumers, the exact fee should also be reflected at the point of sale to the consumer. This would enable greater public participation in the management system.
c. **Transparency**: Reputed third party auditors should conduct the annual audits of the ELV management system. As the government would be a key stakeholder and would provide the mandate to the setting up of the system, additional oversight instruments, which are applicable to the government schemes as envisaged by the Comptroller and Auditor General may be applicable to the ELV management system as well.
d. **Enabling the Development of a Business Case for Environmentally Sound Management of ELVs:** Appropriate fiscal instruments or incentives could be developed to support the development of a controlled and regulated ELV recycling system in the country. These incentives could be provided by the relevant Ministries that are responsible for the development of the Automobile Industry or for the protection of the environment and natural resources.
e. **Multi-stakeholder governance:** The ELV management system should be open to scrutiny by a high-level multi-stakeholder group representing the diversity of interests of the manufacturers, consumers as well as the government. This would ensure that the concerns of the consumer groups as well as the regulatory authorities are suitably represented in a private sector implemented system. However, it should be made clear that this structure cannot be held liable for any malpractices, as it will not be involved in the day to day running of any system set up by the private sector.

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Chapter 7

Responsibilities throughout the life cycle of vehicles & Guidance for Stakeholders

7.1 Environmentally Sound Management of ELVs

Environmentally Sound Management (ESM) of ELVs provides important means for safe recycling and efficient recovery of materials from the ELVs. The figure below provide a step-wise guidance in ELV processing.

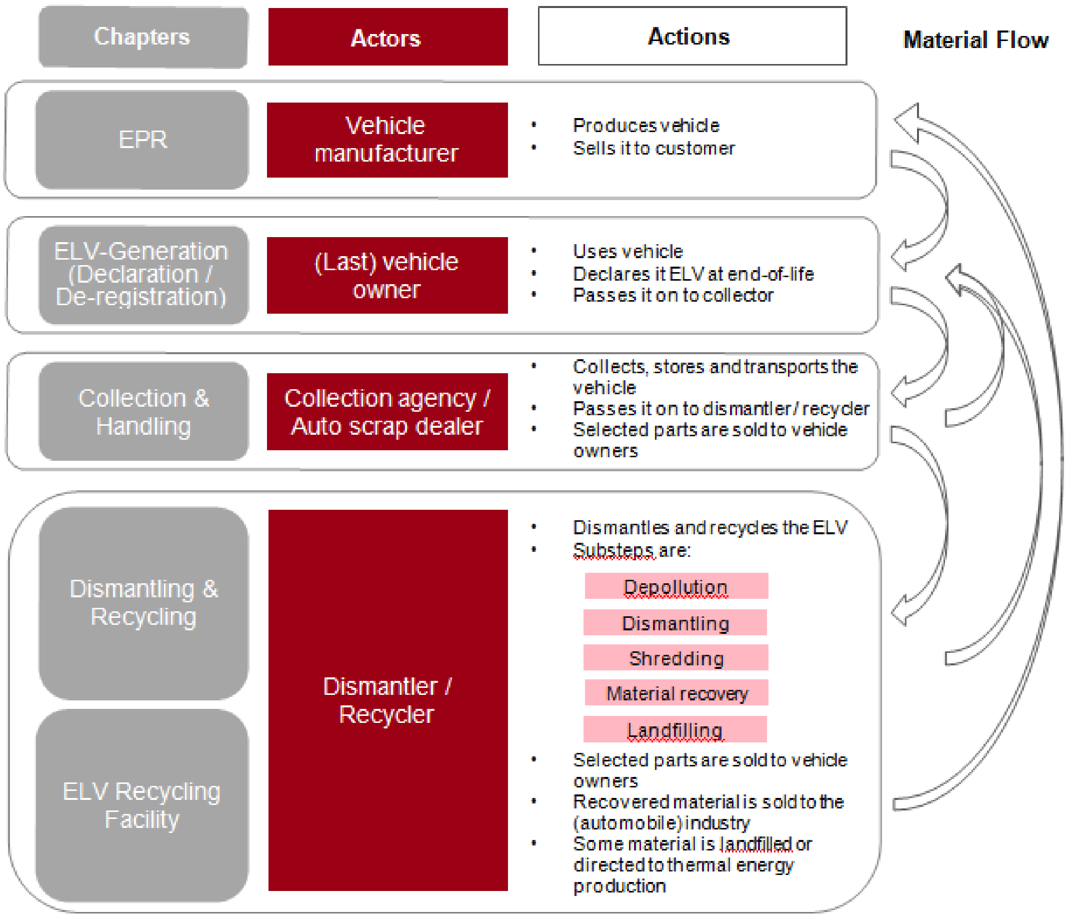

Figure 7.1: Steps of ELV processing

7.2 ELV Demonstration plant: automobile recycling unit, NATRIP

The actual recycling is the most important step in the ELV value chain facilitating the recovery of useful materials from the ELVs thereby reducing the waste destined for disposal and conserving the natural resources. The recycling activity needs to be regulated and monitored in order to ensure that such recycling is carried out in an environmentally sound manner. In India, a state of the art recycling facility using the Best Available Technology (BAT) is yet to be set up.

A demonstration automobile recycling unit has been set up by National Automotive Testing and R&D Infrastructure Project (NATRIP) under the Ministry of Heavy Industry, Government of India in Chennai which provides the basic requirements for ELV recycling infrastructure but a large scale commercially viable unit that can deal with all kinds of ELVs from two and three wheelers to large commercial vehicles like buses and trucks still needs to be set up.

7.3 Responsibilities throughout the life cycle of vehicles – AIS 129

1. Implementing the above-described arrangements will require concerted efforts by Indian government agencies, vehicle manufacturers, the recycling sector as well as vehicle owners. An important stepping stone on the way towards formalizing the recycling sector and triggering more effective ELV management is to involve vehicle manufacturers in the whole life cycle of their products. In India, the automotive industry is making considerable efforts to facilitate ELV recycling at various stages of the lifecycle of vehicles.
2. In 2015 the AIS Committee (AIS Committee 2015) published a detailed set of mandatory Automotive Industry Standards (AIS 129). The AIS 129 suggest that vehicle manufacturers support ELV recycling through improved product design and information dissemination:

    a. PART-2A, para. 3.1: Vehicle manufacturers shall strive to ensure that the vehicles type approved after the mandated date shall not contain lead, mercury, cadmium or hexavalent chromium. Vehicles shall be so constructed as to be: reusable and / or recyclable to a minimum of 80 % by mass, and reusable and / or recoverable to a minimum of 85 % by mass.
    b. PART-2A, para. 4.2: The vehicle manufacturer shall make available the "Dismantling Information" in the form of manuals or by means of electronic media (e.g. CD ROM, online services, etc.) to the authorized dismantling centres.
    c. PART-2B, para. 4.2.1 Vehicles shall be so constructed as to be (4.2.1.1) reusable and / or recyclable to a minimum of 80 % by mass, and (4.2.1.2) reusable and / or recoverable to a minimum of 85 % by mass.
3. Furthermore, the automotive industry has provided comprehensive support to the Ministry of Heavy Industry for setting up an ELV demonstration centre at the Global Automotive Research Centre in Chennai (AIS Committee 2015). The centre seeks to develop recycling processes which employ manual labour to the greatest extent, and particularly procedures for dealing with two-wheelers.
4. Even though the AIS 129 define extensive responsibilities for vehicle manufacturers, these standards are limited to the product design stage as well as information dissemination. Concerning the actual recycling process of ELVs, the AIS 129 lays out mandatory compliance rules for

vehicle owners and dismantling facilities.

5. Constraints / challenges : Particularly collection and dismantling centres will be faced with substantial additional costs for obtaining authorization; paying the last ELV owner a salvaging price according to the value of the ELV; recycling various types of ELVs in an environmentally friendly manner; and disposing of vehicle parts that are deemed non- reusable (AIS 129: § 4.2).
6. The key question remains how to make ELV regulations and the AIS standards of the automobile industry converge towards guaranteeing an environmentally sound management of the ELVs. As it was mentioned in a separate in a chapter in most countries with ELV legislation this is achieved by legally establishing 'Extended Producer Responsibility (EPR)' or by defining other approaches to producer responsibility. In India, EPR is now a part of most waste legislations (e-waste, plastic, batteries and to a certain extent, municipal solid waste). The setting up of a legal EPR scheme has been discussed by organizations of the Indian Automotive Industry. Based on consultations with stakeholders they have come to the conclusion that the setup of an Indian EPR scheme is not feasible due to the fact that "the industry is not developed to that maturity level" (AIS Committee 2015). Consequently, the principle of EPR was not included in the AIS 129. Instead it is believed that "the market economy must take care of the final ELV value offered to the customer" (AIS Committee 2015).
7. However, the vast challenges faced by the recycling sector (e.g. more complex vehicle design, new materials and parts, lack of space, etc.) strongly reduce the incentives for small- scale entrepreneurs to invest in ESM of ELVs. In order to allow for the uptake of efficient technologies and better coordination among different facilities, close cooperation with vehicle manufacturers remains a crucial aspect**.** A holistic approach to ELV recycling would therefore be to set up a 'Shared Responsibility' model that distributes responsibilities among a number of actors – "from producers, recyclers and dismantlers (both formal and informal), to government authorities, and consumers (both private and commercial), dealers/ intermediaries and insurers". In particular the public sectors has the potential to contribute to ELV recycling by providing an adequate policy framework, creating awareness and outreach programmes and generating incentives moving all actors towards the implementation of a comprehensive ELV system. According to this model the responsibilities of the vehicle manufacturers would look as follows:
   1. Extended Producer Responsibility ought to give producers the leeway needed to innovate by choosing materials and structures that aim to make also the dismantling and recycling easier and safer (Lindhquist 2000). This point is already covered by the AIS 129.

ii. The producers will also have to play a major role in strengthening the capacities of the semi-formal sector in regard to dismantling and recycling. This point is partly covered by the setup of the dismantling centre in Chennai. However, this effort is not enough to reach the majority of the semi-formal sector as it is large and spread over various regions of India.

iii. Furthermore, the automobile manufacturers could frame the Standard Operating Procedures (SOPs) for dismantling every model and type of vehicle. The SOPs could be shared with the semi-formal sector in vernacular languages.

iv. Finally, producers also need to set up mechanisms for product take back, with infrastructural and financial responsibility for its effective implementation nationwide. Such a take back system would ensure that all ELVs can be returned for recycling and that the recycling facilities are adequately equipped. The automotive industry has the economic strength to establish and maintain such a system and can thus contribute considerably to ensuring ESM of ELVs. By requiring vehicle producers to take care of the recycling of their products the incentive for building “green” vehicles would be increased. So far, the AIS 129 do not provide for a take back system.

The above considerations are based on consultations with informal ELV recyclers and regulators in order to identify approaches for improving the performance of the sector.

7.4 Guidance for Stakeholders

1. Ministry of Road Transport (MoRTH)

a. The MoRTH is the nodal ministry responsible for the implementation of the Motor Vehicles Act, 1988. Within the purview of the act, the Regional Transport Offices (RTOs) are responsible for registering of vehicles that will ply on roads and ensure that all safety guidelines as prescribed within the act are adhered to by vehicles.

b. Existing regulation around ELVs is incomplete and is often not fully enforced. For example, the de-registration process to be accomplished by the Regional Transport Office (RTO) is not carried out for all vehicles as most of the vehicles are sold as auto junk to the scrap dealers and recycled in the semi-formal sector or abandoned on the road side after accidents, fire, etc. An online central registry is already in place for all vehicles that are registered. A similar registry needs to be prepared for those that have been declared ELV either natural or pre- mature at the location of the ELV and not at the location of registration. The RTOs may work in partnership with the local municipalities especially for the deregistration of abandoned vehicles within municipal areas.

c. Testing and roadworthiness standards should be strengthened to balance the environmental concerns with the economic incentives of the producers. While, vintage based vehicle retirement initiatives might be attractive to the industry, they are likely to impose increasing demands on the environment through the use of ever-more raw materials. At present, the registration certificate for a heavy vehicle is issued for 10 years while that of a four-wheeler or two-wheeler is issued for 15 years. The duration of these certificates should be reviewed so that vehicle owners are not inconvenienced unduly and at the same time the environment is not harmed by the continued use of polluting vehicles.

d. The ministry should appoint a nodal authority that will be responsible for monitoring of standards employed at the production stage of vehicles. The recyclability and recoverability rates as specified should be adhered to and guidance on dismantling should be provided to all formal dismantlers within 6 months of launch of a new vehicle. Design conformity should be set and monitored through standards such that recyclability and recoverability rates are met.

e. Guidance should also be offered to municipalities in the form of awareness and outreach programmes that can be designed by the ministry such that they are able to educate and spread awareness on the environmental hazards posed by vehicles which attain ELV status.

f. The municipalities may be asked to report on an annual basis on the quantum of ELVs impounded within their jurisdiction.

2. **Ministry of Heavy Industries & Public Enterprises (MHI & PE**)

a. The Ministry of Heavy Industries and Public Enterprises is the nodal Ministry governing the automotive industry in India. As a first step the Automotive Industry Standards 129 (AIS 129) have been published in 2015 providing guidance on collection and dismantling of ELVs by authorized centres as well as describing provisions that manufacturers should take in order to increase the recyclability of vehicles.

b. The AIS 129 must be integrated with a 'shared responsibility' model combining producer responsibility with consumers and disposer responsibility. While the main objective of the standards is to provide guidance in handling end-of-life vehicles and to describe procedures for ESM of ELVs, in order to provide a practical operational system for dealing with the ELVs in India a system for 'shared responsibility' is being proposed in these guidelines. It is important to note that the automotive industry requires not only mandatory compliance with AIS 129 but a mechanism needs to be put in place for ensuring its enforcement. The AIS 129 provide for standard operating procedures for dismantling of ELVs for its environmentally sound management. The ministry should increase its outreach with key stakeholders like Municipalities such that the semi-formal sector which is present in most Municipal areas of the country so that it made aware of the same and are conscious about environmental issues related to vehicle repair, dismantling and recycling.

3. State Pollution Control Boards (SPCBs)

a. The State Pollution Control Boards have a critical role in ensuring that the different actors involved in the ELV value chain are made aware of these guidelines. The SPCBs may conduct outreach and awareness activities to enhance the awareness of the stakeholders on the environmental impacts of ELVs.

b. The SPCB would be responsible for the registration of dismantlers and recyclers of ELVs in partnership with the MoRTH. They may also be involved in the quantification of ELVs as well as in identifying the hot-spots of ELV recycling within a state. This would enable the development of appropriate infrastructure and the mapping of material flows within the state boundaries. Also, the SPCBs would be responsible for providing clearances for the inter-state transfer of ELVs for dismantling and recycling

c. With the rising volumes of electronics and plastics in ELVs, there would be a challenge of managing e- waste and plastic waste emanating from ELVs processing activities. As SPCBs are currently involved in monitoring the implementation of the e-waste and plastic waste rules, integrated infrastructure development at the state level should take into account the synergies across these different waste streams. Forward-looking businesses that wish to develop infrastructure and that combines several waste streams should not be discouraged by the SPCBs.

d. There needs to be specific guidelines in place for ASR. As infrastructure for handling ELVs develops, the SPCBs would have to face the challenges due to open dumping of ASR. The concerned private operator should arrive at land-filling costs of ASR and the quantum of ASR for disposal should be guided by recyclability and recoverability potential as identified in AIS 129. Reporting guidelines on ASR management need to be put in place for the formal sector dismantlers and the same should be slowly disseminated to the semi-formal sector as well.

4. Manufacturers

a. Manufacturers should ensure that mandatory standards of AIS 129 are adopted and designs of vehicles conform to the standards set for material recoverability and recyclability. It is also important to ensure that self-enforcement of these guidelines takes place and a shared responsibility framework is developed including viable business models for cooperation with the semi-formal sector.

b. Manufacturers would be the key actor responsible for the functioning of a 'Shared Responsibility' model outlined in this document. By taking up their key function in the shared responsibility model, the manufacturers would not only fulfil their environmental responsibility but would also be able to take advantage of the business opportunities and recovery potential emerging from the handling of ELVs.

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Chapter 8

Way forward

8.1 Introduction

ELVs are fast emerging as an environmental challenge in India. Taking cognizance of the evolving dynamics of the Indian market conditions and drawing lessons from international experiences, these guidelines examine the key issues in relation to setting up an Environmentally Sound Management (ESM) System of ELV in India, the outline the critical elements of a way forward is depicted in the figure below.

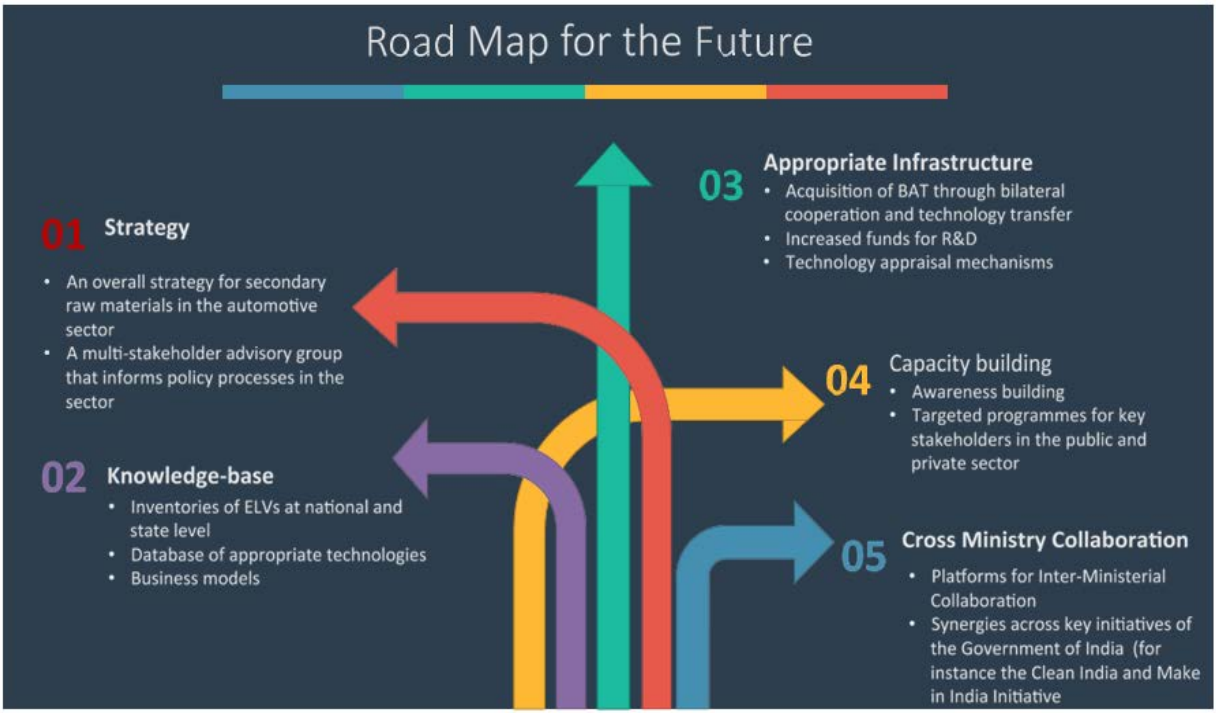

Figure 8.1 : Elements of a ELV Roadmap for India

8.2 The strategy

1. The first crucial element of the way forward is developing an over-arching strategic framework for the environmentally sound management of ELVs in India, although, several Ministries and the automobile industry are undertaking initiatives however, the management of secondary raw materials in the automotive sector is still not available.
2. Given the rapidly expanding nature of the automobile sector and the increasing obsolescence rates, it is critical to develop a strategy that promotes closed loop manufacturing processes that makes maximal use of resources embedded in ELVs in an environmentally sound manner. Such a strategic framework would provide orientation to both industry and policymakers about the impact of raw material demand on the environment. Further, such a framework would propose options for minimizing this impact on the environment including the potential use of

resources embedded in ELVs.

3. The Ministry of Environment, Forests and Climate Change may develop this framework in consultation with all the other concerned Ministries.
4. A key contributor to developing such strategic orientation would be through the constitution of a multi-stakeholder advisory group that informs policy processes in the sector. Such a multi-stakeholder advisory group would bring together the diverse perspectives that influence and, in turn, are affected by policy decisions. The key role of such a multi-stakeholder group would be to provide evidence-based support to the policy formulation process. Further, this group would also provide a platform for the convergence of the diverse perspectives that, in the absence of such a platform, have the potential to drive policy processes in several directions.

8.3 The knowledge base

1. The development of an environmentally sound management system on ELVs would depend on regular information flows as well as an updated knowledge base that provides information to all the concerned stakeholders. For instance, the development of appropriate infrastructure would depend on the availability of data on the quantity of ELVs being generated in India. Similarly, industries desirous of setting up infrastructure for the management of ELVs would benefit from the availability of information on appropriate technologies. Further, given the complex nature of ELV management in the country, with a significant proportion being managed in the semi-formal sector, it is critical to document and propose innovative business models on to ensure controlled and regulated material flows.
2. To develop an overview of the quantification of ELVs should be done on a regional as well as national basis. The CPCB, along with GIZ, and SIAM have developed preliminary figures independently on the amount of waste due to ELVs. These numbers should be updated in an on-going manner.

   A compendium of best available technologies in the ELV recycling sector should be prepared regularly in order to guide the development of appropriate infrastructure for the environmentally sound management of ELVs.
3. As noted above, a majority of ELVs are currently handled by the semi-formal sector in India. In order to channelize the ELVs to a regulated channel, innovative business models would have to be developed bridging the divide between the semi-formal and formal sector. Such business models would be based on international as well as national experiences on ELVs as well as other sectors. Consultants commissioned by the Government or the private sector, under the guidance of the multi-stakeholder advisory group proposed above, could prepare such a compendium of business models.

8.4 Appropriate infrastructure

With the rising quantities of ELVs, appropriate infrastructure would have to be developed to ensure that there are sufficient capacities to handle them in an environmentally sound manner. The infrastructure may be developed by the private sector or through a Public- Private Partnership (PPP) mode. Given the experiences of setting up an ELV recycling plant, the Ministry of Heavy Industries and Public Enterprises should take the lead in promoting the development of such infrastructure in partnership with the private sector.

There should be an increased allocation of resources for Research and Development (R&D) in this sector with funds allocated by all the concerned Ministries. The Ministry of Heavy Industries and Public Enterprises may support R&D in infrastructure. The Ministry of Environment, Forests and Climate Change may support R&D in resource efficient and climate friendly technologies for secondary material utilization. The Ministry of Road Transport and Highways may support R&D in developing technologically advanced roadworthiness testing infrastructure.

Ministry of Heavy Industries and Public Enterprises can set up of technology appraisal mechanisms to evaluate the proposals of the prospective dismantlers and recyclers and associate CPCB in the exercise. Most of the infrastructure set up would need the attention of the State Pollution Control Boards. In order to strengthen the evaluation of these proposals, a technology appraisal mechanism should be established so that the setting up of infrastructure is not delayed due to the constrained capacities of the SPCBs.

The unique feature of India is the large number of two (2W) and three wheelers (3W) for which an indigenous recycling model needs to be developed as there is no global model available. For four wheeler ELVs recycling systems are already available in other countries but it needs to be explored how it can be adapted to the Indian context.

8.5 Capacity building

The capacity building strategy should be developed for the environmentally sound management of ELVs in India. Such a strategy should be developed by analyzing the critical capacity gaps and would involve cooperation across the different Ministries. The Training Institutes and Centres of Excellence associated with the line Ministries could develop the capacity building strategy.

In line with the developed capacity development strategy, training and awareness programmes should be conducted to enhance the understanding of the involved stakeholders on the challenges and opportunities presented by ELVs. The trainings to be developed on both technical and non-technical topics depending on the needs of the target groups. The line Ministries may allocate funds and certain programmes may be conducted in partnership with the private sector.

The OEMs and producers, through the Industry Associations like SIAM and ACMA, can generate awareness amongst consumers on the need for environmentally sound management of ELVs.

8.6 Cross country collaboration

The challenges posed by the rising quantities of ELVs cannot be solved through the efforts of any single Ministry. It would require collaboration amongst the concerned Ministries. These guidelines have on several occasions referred to the role played by the different Ministries to ensure environmentally sound management of ELVs.

An Inter-Ministerial Working Group needs to be constituted to ensure that a collaborative approach between the concerned Ministries is institutionalized to provide a platform for discussions on synergizing resource allocations by the different Ministries for the environmentally sound management of ELVs.

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