India International Vehicle Recycling Summit

END-OF-LIFE VEHICLES (ELV'S) DIRECTIVE

Challenges, Prospects and Potential in context to India

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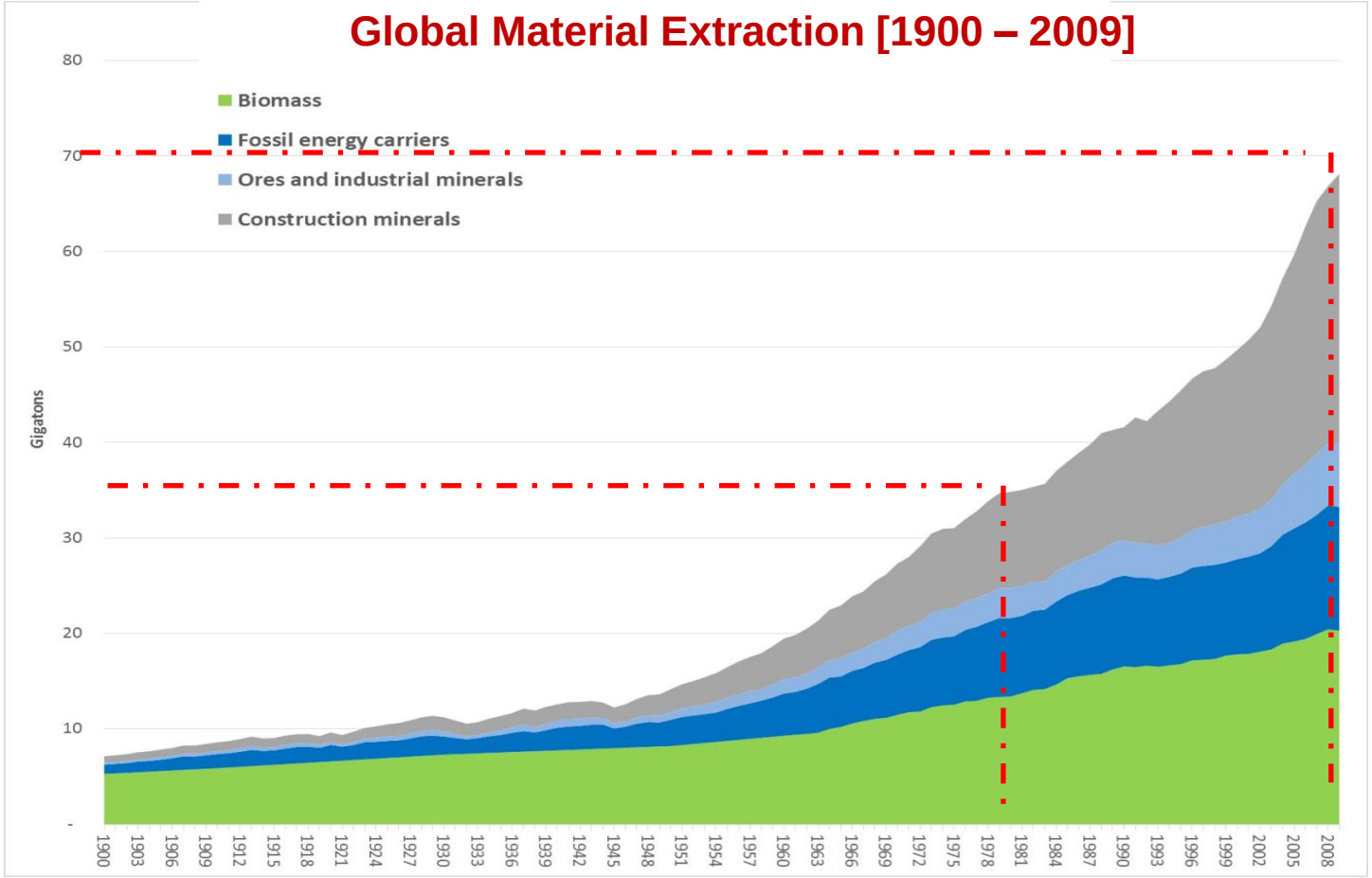
Organizers: Auto Recycling World, ICOE Recreating mother Earth

Sponsors: powerhand, Scrapoto

Partners: EGARA, MRAI, SYNETIQ, ATF Pro, ARC, Automotive Recyclers Association

27, 28, 29 April 2021

Global Material Extraction [1900 – 2009]

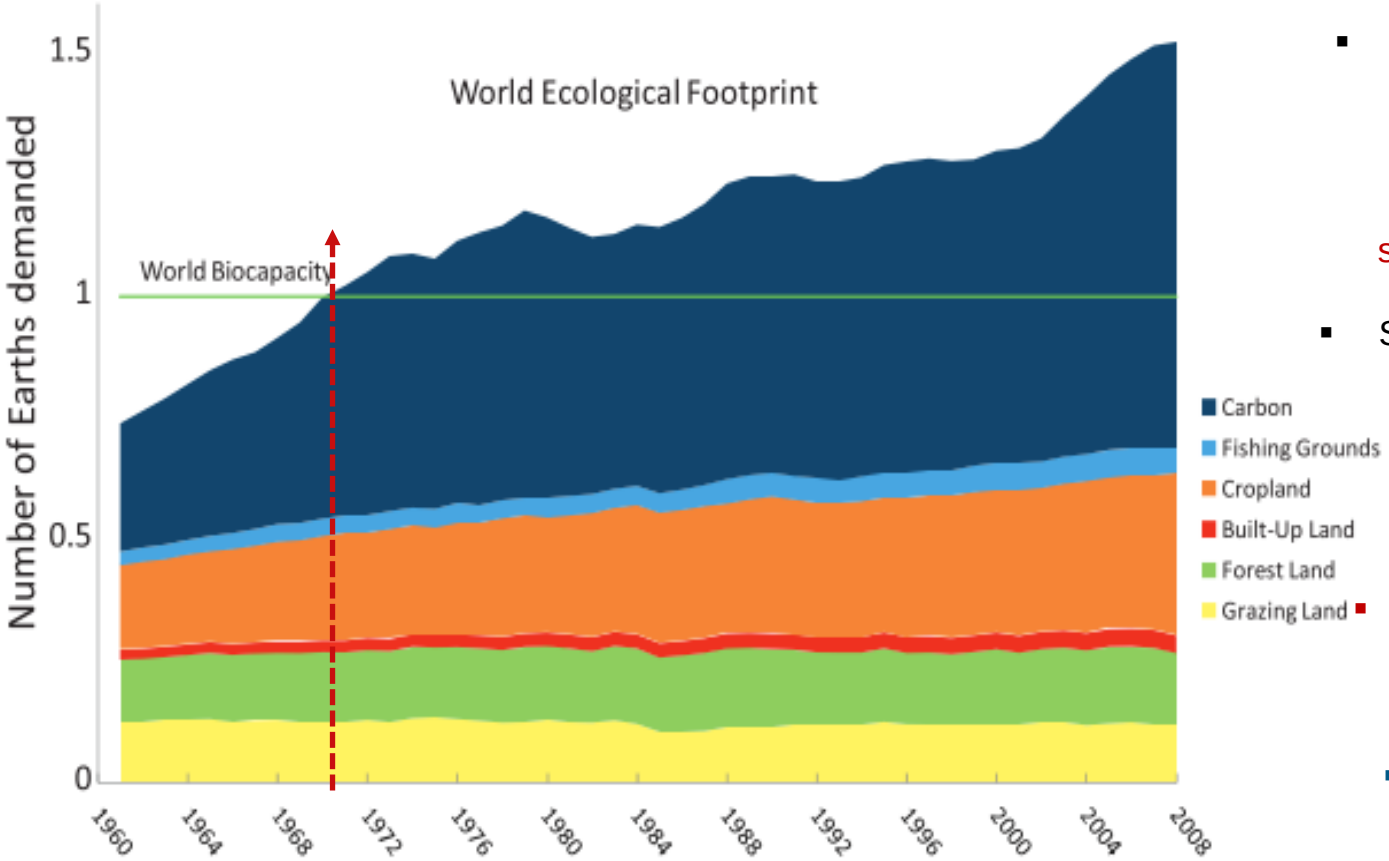


Global Challenge: Resource Extraction doubled in 30 years

(1980: 35 bio. tons to 2010: 70 bio. Tons) …..2050 ?

Source:
BMUB and *Krausmann et al. (2009): Growth in global material use, GDP and population during the 20th century, Ecological Economics Vol.68, No10, 2696-2705, Version 1.2 (August 2011)*

Comparison of Humanity's Ecological Footprint Vs No of planets and 'Overshoot' (1960-2008)

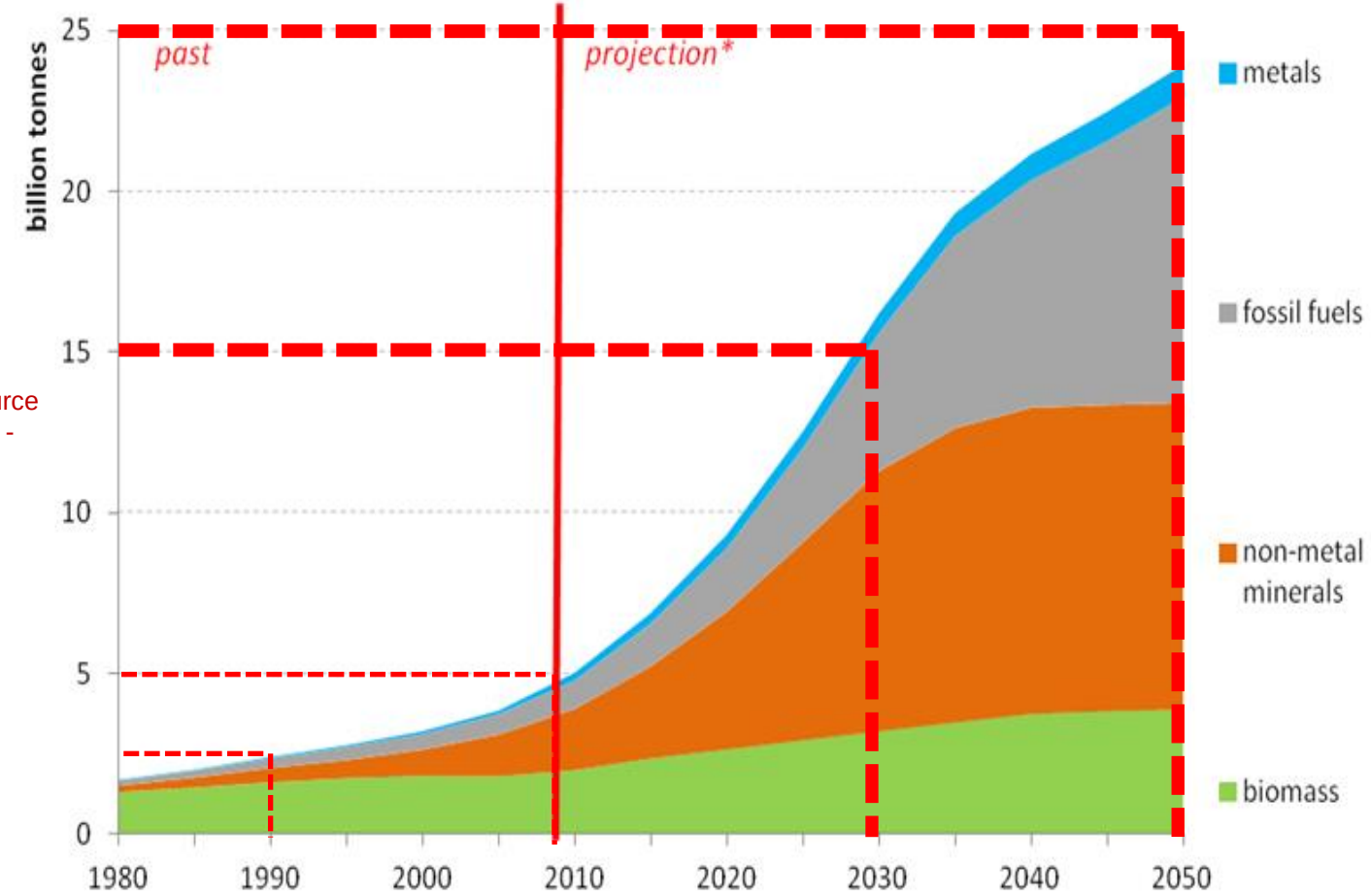


- If global economic development continuing in a business-as-usual mode and projected population growth of 30–40% until 2050 (UNDP, 2006), we should expect another sharp rise in global material extraction.
- SO, reduction of global materials use is must..?
- **or at least stabilization at the current level…?** will require major reductions in metabolic rates
- SO, waste shall be looked as SRM creating examples of CE

Humanity's footprint first exceeded Earth's total bio-capacity in 1970s and this overshoot has been increasing since then and today we are consuming resources equivalent to 1.5 number of earth

(Source: Borucke et al., 2013)

India : Highest resource extraction pressures - 1,579 tonnes/acre compared to global average of 454



*Main assumptions: India follows typical material use pattern during development process; economic growth rates of about 8% p.a. until 2030, thereafter around 7% p.a. until 2035 and 6% p.a. until 2050. Data sources: Dittrich, 2012, SERI, 2011, TERI, 2012, UNData, 2012, Worldbank, 2012

India : Projection of future material consumption patterns

LEARNINGS

Since, 50% of the world's population living in the Asia-Pacific region decisions made here in this region will reverberate around the globe

Particularly decisions made by India and China will be especially significant in global sustainability equation *(Galli et al., 2012)*

Decisions has to be Judicious.

Directives must be Judicious and Responsible, which shall also cater domestic conditions.

[not like investing in Post Shredder Techniques (PST) – which may work in EU due to high cost of manpower otherwise, but its not the case in India]

ELV Management: Does have an established (ISO) Supply Chain Mechanism

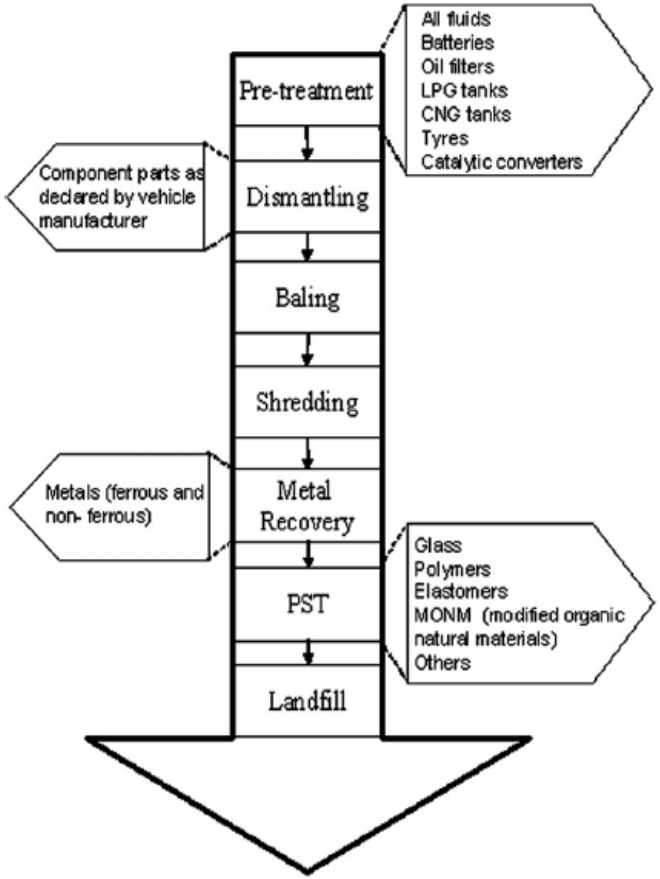
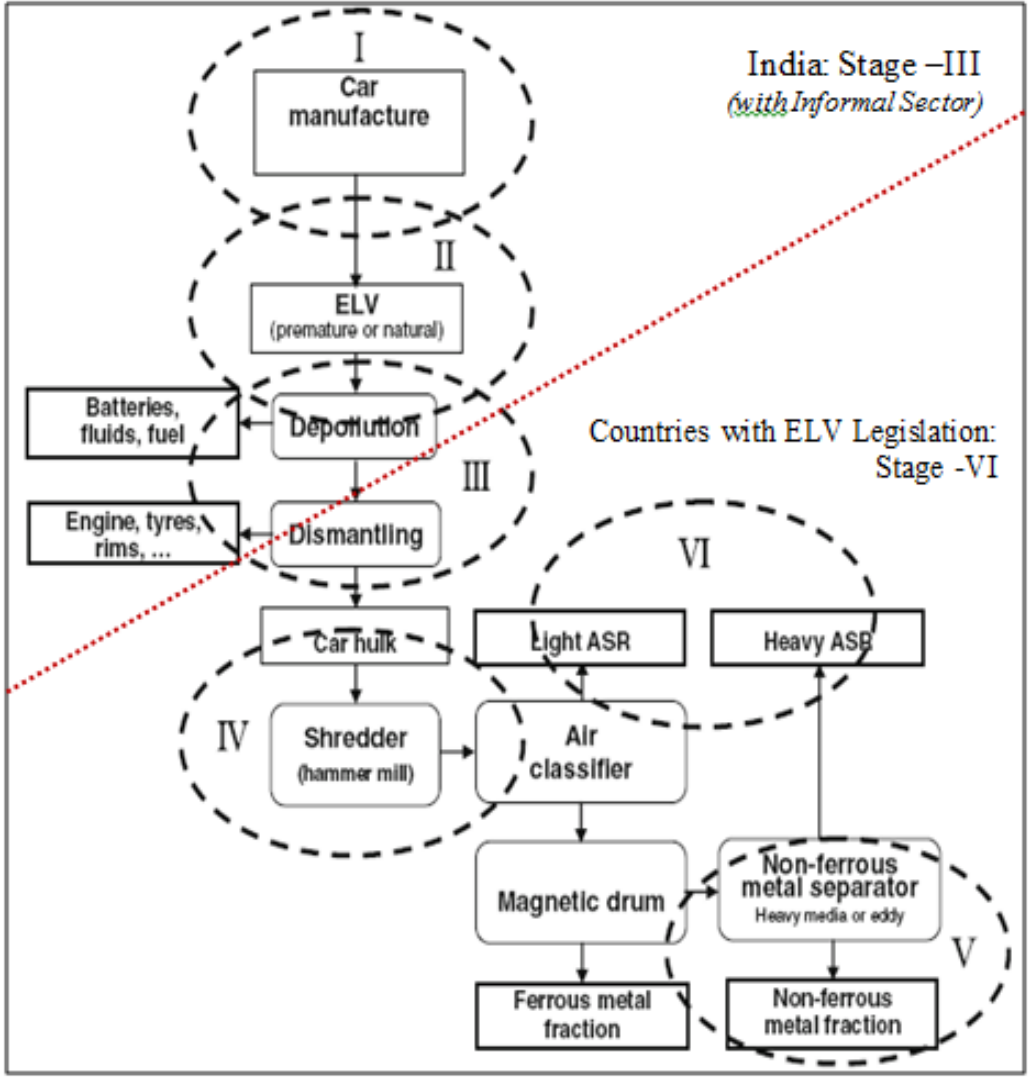


Figure-11: ELV supply chain according to ISO 22628 (International Organization for Standardization, 2002).
(Source: Morselli, Santini, Passarini, & Vassura, 2010)



Stages of ELV Management
Source: Sakai et al., 2014

ELV Management: Global (Regulated) Practices

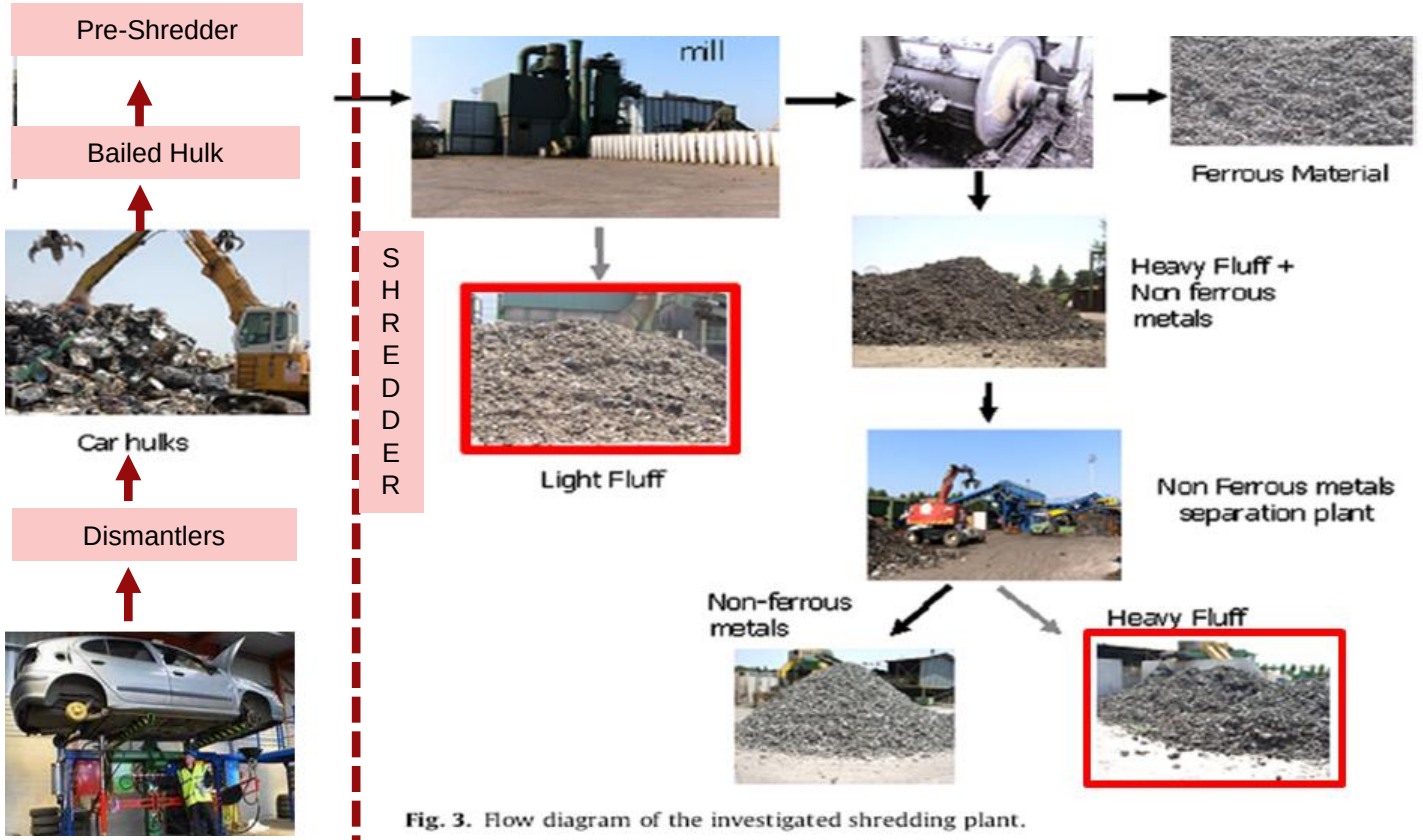


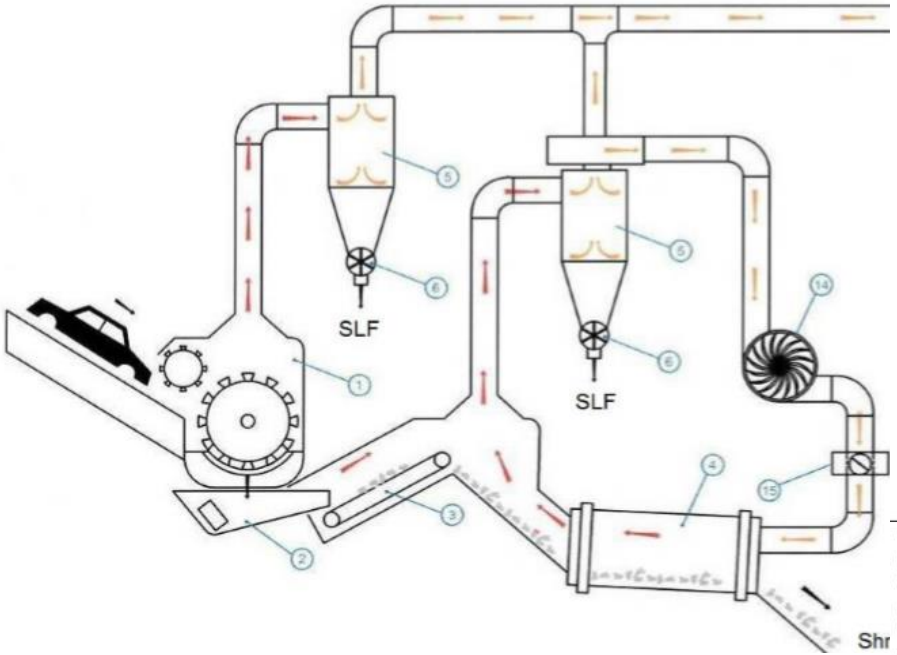
Fig. 3. Flow diagram of the investigated shredding plant.

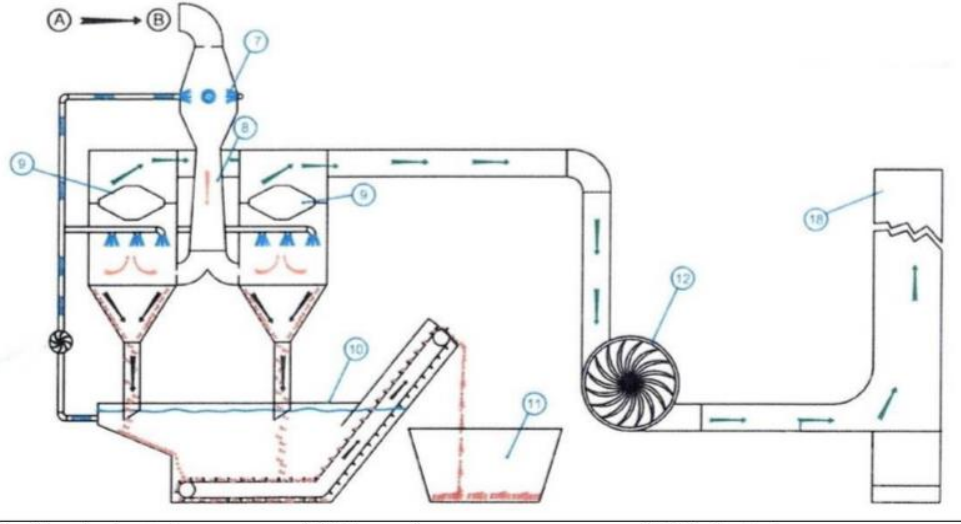
Post Shredder Treatment

[co-incineration or use of thermo-chemical processes (pyrolysis or gasification)]

Flow Diagram of ELV Shredding Plant, Bologna (Northern Italy) Source - Morselli et al., 2010

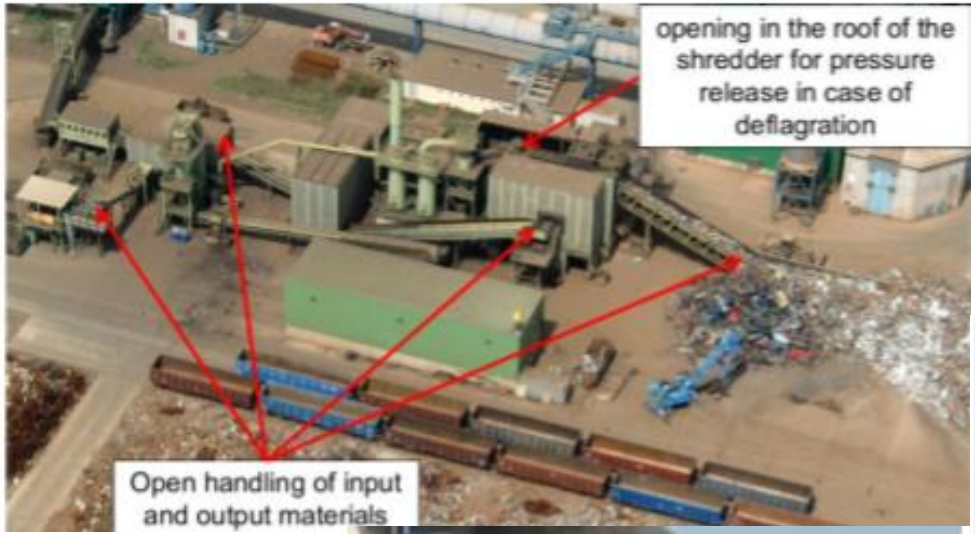
ELV Management: Shredder Plats Overview





(1) Shredder chamber tank
(2) Vibrating conveyor
(3) Conveyor
(4) Density separator
(5) Cyclone exhaust
(6) Rotary valve
(7) Water injection
(8) Venturi tubes
(9) Droplet separator
(10) Settling tank
(11) Sludge tank
(12) Exhaust fan
(14) Ventilator
(15) Flap
(18) Clean air exhaust

Source: [26. Mech. subgroup 2014]



Source: [26. Mech. subgroup 2014]

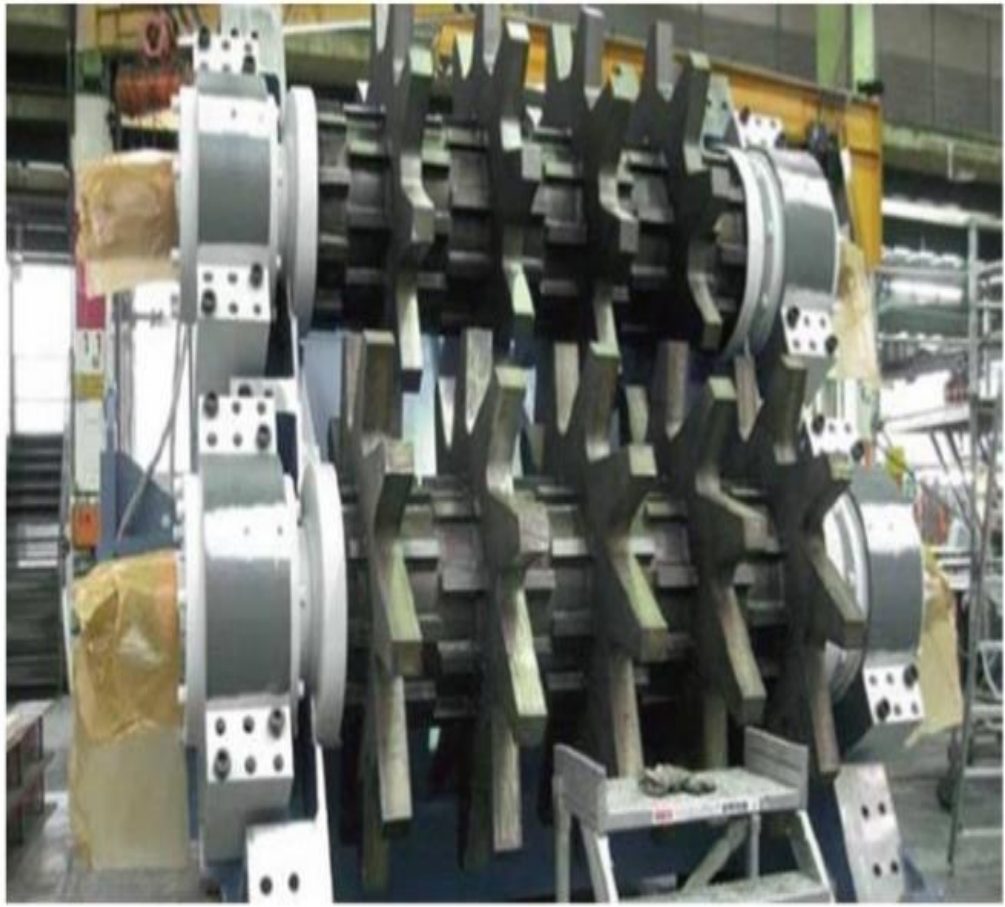
Deflagration

Source: [26. Mech. subgroup 2014]

Source: [26. Mech. subgroup 2014]

- 44 kWh/tonne input material (70 % Fe, density 1 t/m³) to about 25 kWh/tonne.
  40 kg CO_2 e/tonne of input material to 20 kg
- Air emissions/control systems/reverse water spray
- Only Shredder reported upto 3000 HP motors

- Equivalent power: 3000X0.746 = 2238 kW
- Number of hours per day: 8
- Total power consumption [2283X8]= 17,904 kWh
- CO_2 equivalent emission: 14.68 tCO_2e/day



Source: [26, Mech. subgroup 2014]

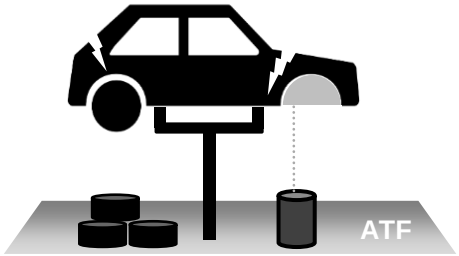
Dismantling and recycling of ELVs; Germany- 2020

About 500 000 ELVs per year
(about 1000 kg each)

Optional: Take back points

1100 Authorized dismantling facilities
(Dismantling, depollution)

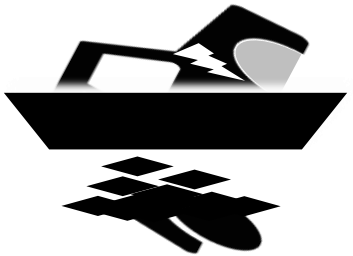
- spare parts
- fluids
- recyclable materials



85-90 % other scrap

Stripped vehicles

10-15 %



40-50 Shredding facilities

Shredding scrap (Fe)

Shredder light fraction

Shredder heavy fraction with non-Fe metal (Al, Cu)

Further treatment (e.g. density separation)

Source: ELV Congress, India // ELV management in Germany, R. Kohlmeyer (UBA) February 2020:

ELV Global Challenge: ASR; its hazardousness Vs Resource Potential

Table :Average composition of ASR (Ciacci et al., 2010)

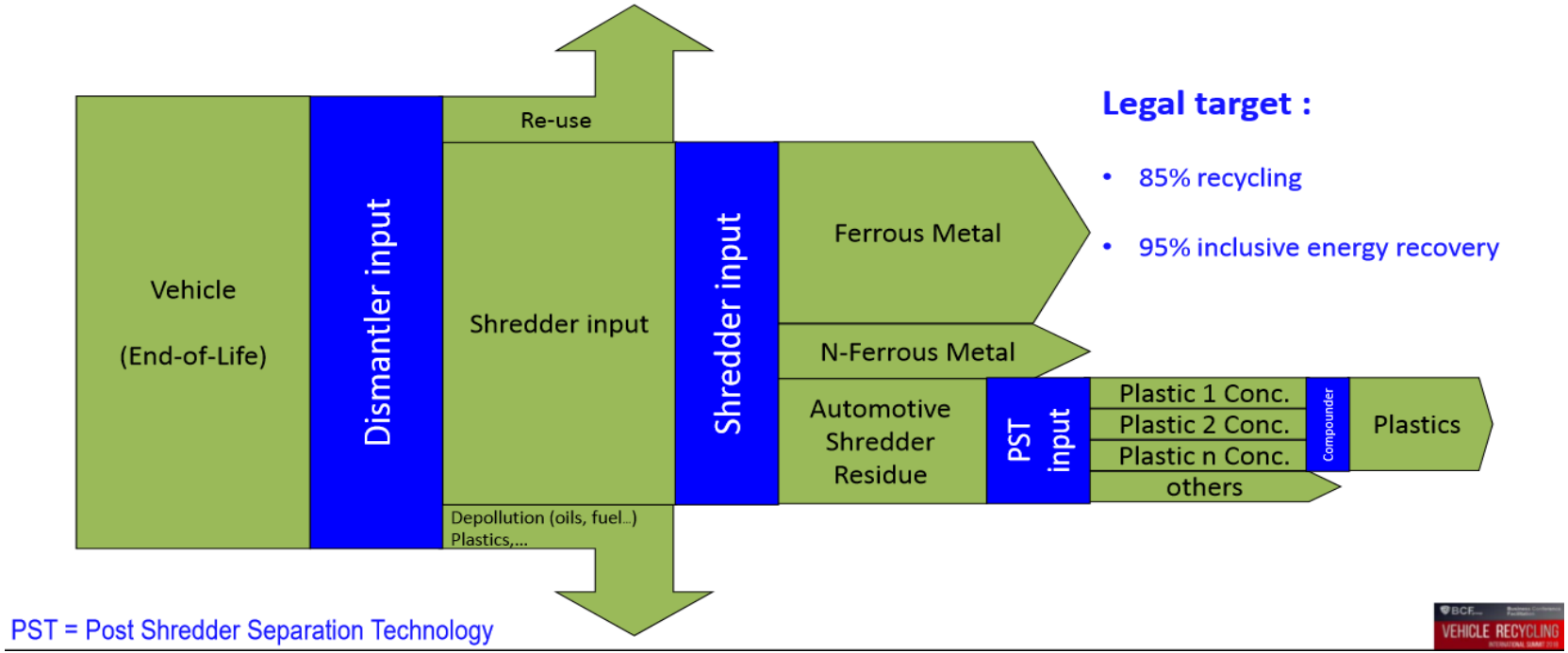
Material type	Average composition (% weight)
Plastics	35-55
Rubber	10-20
Metals	6-13
Textiles	7-15
Fines (paint, glass, sand)	10-20

Automobile shredder residue (ASR) generated in a metal shredding facility in Melbourne

Table: 01 Average composition of ASR (Ciacci, Morselli, Passarini, Santini, & Vassura, 2010)

- ASR (Car Fluff) compositions makes ELV management tougher
- Contains Hz substances as Lead, Cadmium, PCB, BFRs, etc
- Gasification/Melting (Japan) tried successfully
- Still contains up to 8% of metals and 40% of polymers that could be recovered

ELV Global Challenge: ASR; its hazardousness Vs Resource Potential



Source: EU-Directive 2000/53/EC on ELV; which says that EU members shall attain reuse or recovery and reuse or recycling rates of 85% and 80%, respectively, by 2006 and of 95% and 85% by 2015) (Sakai et al., 2014).

LEARNINGS

- Treatment of ASR – most important processes in ELV management.
- Hazardousness of ASR – value as SRM to substitute depleting resources **both needs to be addressed.**
- **Countries with a legislative ELV system commonly set target for recovery rates around ASR** (many aiming for more than 95 % recovery).
- **International regulations on ASR treatment expected to become stricter** in the years to come, as can be seen in the emerging demand for the international regulation of brominated flame retardants, the treatment of components containing mercury in line with the treaty on the control of mercury, the control on unintentionally produced POPs during the heating processes.
- Recycling of ASR is important for overall ELV regulation (though it's considered difficult) **since it has high calorific value, ash content, heavy metals and fine particles** that are hard to separate

LEARNINGS

- In this regard, **ASR recycling in the EU has taken two directions:**

  Direction-01:Intensive dismantling involving separation/collection of materials at the dismantling stage; and

  Direction-02:Post Shredder Treatments (PSTs) involving the collection of materials from ASR, after the shredding stage.

- It's proven, that **intensive dismantling would reduce the generation of ASR** as well as its hazardousness. Kohlmeyer

- Intensive dismantling, plastics/and glass undergo material recycling processes, **while in the PSTs, plastics are used in thermal recovery**, and glass ends up in final disposal sites as a backfilling material.

LEARNINGS

- Also **metals in the Shredder Light Fraction (SLF) which is even further problematic part of overall ASR**, their separation before shredding would take place only via intensive dismantling because in PSTs, they are separated again from the SLF, **hence need more processing.**

- According to Vermeulen, intensive dismantling would be effective in protecting the environment, its economic efficiency is unreliable due to rise in labor cost and drop in price of collectable materials, hence application of PSTs better option to meet EU regulation

- **Carbon/Energy Intensive,**

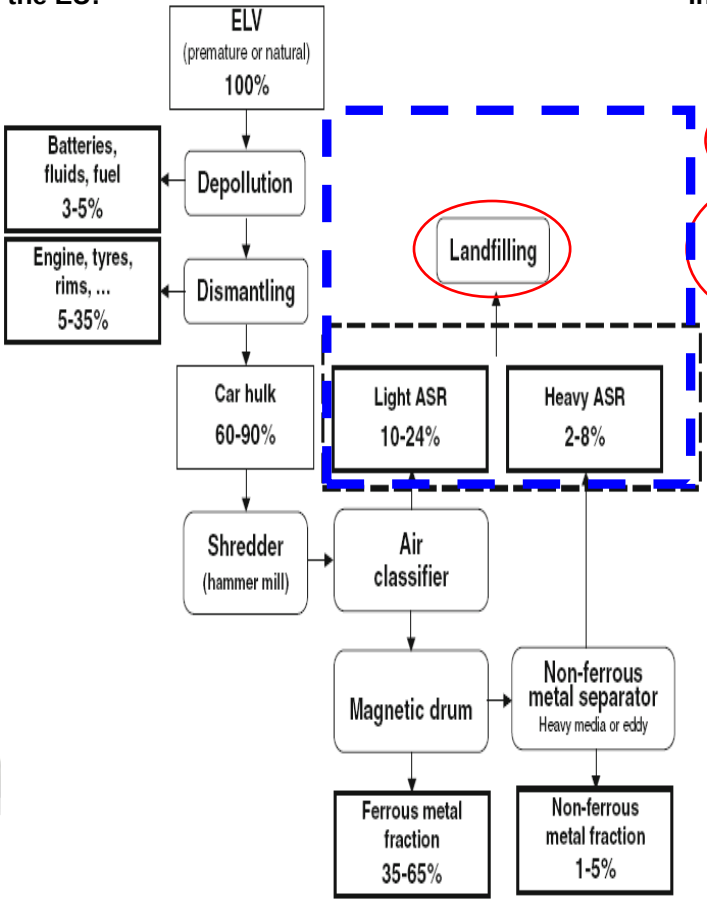
- Intensive Dismantling will reduce ASR and so reduce PST cost

Ferrous material reducing, Non-Ferrous Increasing, so problem of ASR will further increase and so subject needs constant research

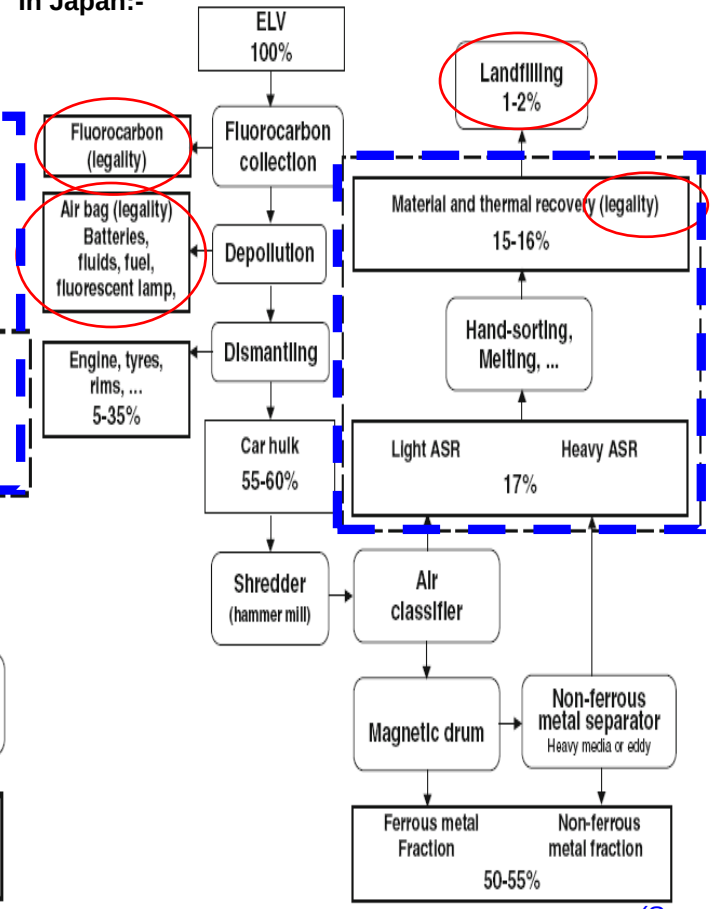
Table-02; Page 14: Material compositions of newly built vehicles in Germany from 1980 to 2000 (GHK/Bios, 2006)				
Material	Production year			
	1981-1985	1986-1990	1991-1995	1996-2000
	Relative mass per cent			
Ferrous metal	**83**	**67.5**	**62.4**	**57.5**
Non-ferrous metal	**4.3**	**6.1**	**8.0**	**10**
Plastics	**3.6**	**4.9**	**6.2**	**7.5**
Textiles	**4.0**	**5.1**	**6.2**	**7.3**
Tyres/rubbers	3.8	3.8	3.9	3.9
Glass	3.1	3.8	4.5	5.2
Liquids	2.9	2.8	2.7	2.6
Other	5.3	6.0	6.1	6.0

Global trend in ELV generation

In the EU:-



In Japan:-



(Source: Sakai et al., 2014)

EU: EU-Directive 2000/53/EC on ELVs (2000)

- Directive was the first EU waste directive with which the EU Commission introduced the concept of EPR responsibility.
- Aims to control the generation and disposal of wastes from automobiles through the promotion of reuse, recycling and collection of ELVs and their components.
- Directive is based on the subsidiary principle wherein member states must establish their national legislations on the ELV recycling system with recycling targets for different phases.
- Member states are also required to meet the targets, while car manufacturers and importers shoulder the expense of recycling under EPR.
- Targets that member states must meet for ‘‘reuse and recovery’’ and ‘‘reuse and recycling’’ rates are: 95 and 85 %, respectively, after 2015.
- ‘‘reuse and recovery’’ includes energy recovery in addition to ‘‘reuse and recycling’’.

(energy recovery is accepted up to 5-10 % for 2006 & 2015 targets, respectively).

US

- ELV recycling has been promoted by Automotive Recyclers Association (ARA), although there is no mandatory recycling target, the rate of material recycling was reported to reach 80 % [36].
- More emphasis placed on the promotion of environmentally sound management at the dismantling or recycling facilities than in integrated management system.
- In particular, dioxins, furans, polycyclic aromatic hydrocarbons (PAHs) and greenhouse gases require monitoring.
- It would also be considered important to take sound measures for the control of hexavalent chromium and mercury, as well as brominated flame retardants and phthalate compounds that require careful monitoring for their hazardousness [5].
- ELV recycling program subject of strict monitoring under environmental laws.
- Among the relevant regulations are the Resource Conservation and Recovery Act (RCRA), the Clean Air Act (CAA), and the Clean Water Act (CWA).
- In addition to federal laws, state governments also impose their own regulations
- ARA disseminates complementary information to ELV recyclers regarding the latest environmental regulations at the state level through an electronic database [37].

KOREA- Resource Recycling of Electrical and Electronic Equipment and Vehicles Act – 2008 [30]

- Prior to this act, government had been employing EPR on its waste management policy.
- ACT further enhanced the EPR policy, which evolved into the Integrated Product Policy through the introduction of the **Eco-assurance System** [31].
- The **Eco-assurance System** requires both preventive and follow-up management:
  - **Preventive-** is to ensure environmentally friendly design and manufacture of products,
  - **Follow-up Management -** to conduct environmentally sound management of wastes [33].

- **Responsibility for ELV recycling is placed on all stakeholders involved**, including manufacturers, importers, dismantlers, shredders,
- **ASR recyclers and refrigerant gas processors, and the recycling rate is mandated** [15].

- Material recycling and energy recovery'' target was set at a minimum of 85 % by 2014 (including energy recovery of less than 5 %), and at least 95 % after 2015 (including energy recovery of less than 10 %).
- If ELV recycling cost exceeds the price of the ELV, the **excess cost is shouldered by the manufacturers and importers.**

Japan – Law for the Recycling of End-Of-Life Vehicles; 2005 [24]

- **To reduce ASR due to shortage of disposal sites**, as well as the prevention of illegal dumping and unsound treatment of ELV the act intends to set appropriate roles among players
- **The act characteristically specifies components/ materials to be recycled,** stakeholders who covers recycling costs, as well as information management system.
- Recycling targets separately determined for airbags, refrigerant gas, ASR **(not for whole ELV).**
- Furthermore, **environmentally sound treatment of the fluorocarbons is required**.
- **Recycling rates for airbags and ASR** from 2015 are 80 and 85 %, respectively.
- Recycling of ASR, thermal recovery is acceptable (no recovery rate).
- **Car manufacturers and importers are responsible for –** recycling of air bags, ASR, and the sound treatment of fluorocarbons
- **Recycling fees are paid by buyers at the time of purchase**, and these fees are **deposited into the deposit management entity.**

Implementation!

#	Country	Motor vehicles per 1,000 people	Total	Year
	San Marino	1,263		2013[5]
	Germany	589	48,427,094[8]	2015
	Austria	598	5,201,750[8]	2015

ELV-Recycling 2017 in Austria

ARGE-SHREDDER

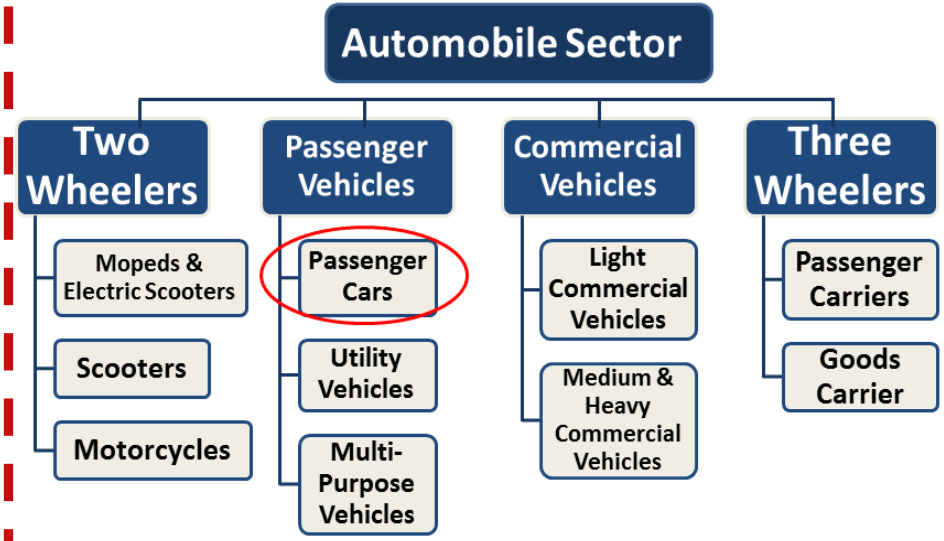
- Collection of ELV´s:
  - ~ 1.500 collection points of the 2 ELV-Systems „Österreichische Shredder“ and „ÖCar“
  - ~ 4.000 Car-Dealers („erlaubnisfreie Sammler“)
  - ~ 160 certificated treatment facilities („genehmigte Sammler / Behandler“)

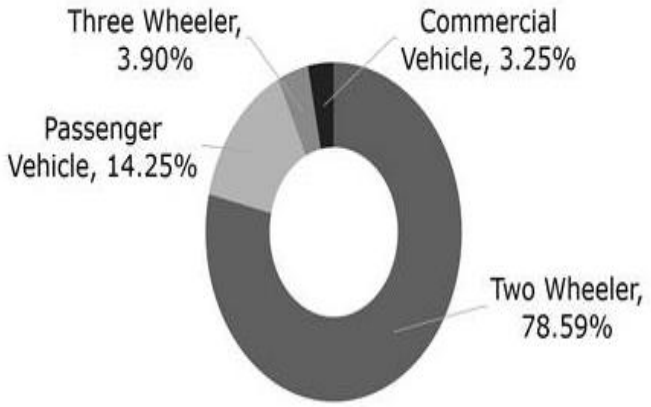
Automobile Industry in India and ELV

- Automotive industry is one of most resource-consuming sectors (Jody & Daniels, 2006)
- Indian auto industry is one of the largest in world and accounts for 7.1 % of India's GDP (ELV-CPCB-Guidelines, 2016)
- Passenger Vehicle (PV) segment second largest market share of 14 % and Passenger Car holds biggest share

- Make in India' - number of vehicles expected to reach 9.4 million by 2026 (Auto Mission Plan 2016–2026).
- Scheme for faster adoption of Electric/Hybrid vehicles under National Electric Mobility Mission 2020 to encourage progressive induction of these PV's
- This will increase burden on informal sector way beyond its handling capacity and so government will have to come up with more formal setups.

https://www.makeinindia.com/article/-/v/automobiles
https://dhi.nic.in/writereaddata/Content/NEMMP2020.pdf





Source: IBEF, June-2017 Market Overview of Automobile Sector

Mayapuri -Delhi,
Pudupet- Chennai, Ukkadam-Coimbatore,
Mallick Bazaar- Kolkata
Lohar Chawl-Mumbai

Informal Dismantlers (Delhi - Mayapuri):

- Use of secondary raw materials (SRM) to the fullest
- Method is crude and unscientific/non-environment friendly
- Handling of ELVs by informal dismantlers here, leads to leakages of hazardous constituents like glass wool, fog lamps, waste oils, coolants etc., which needs immediate attention
- But, they somehow retain materials to quite an extreme, by manual operations - hammers and chisel.
- From Jumbo Military truck to single iron bolt, they don't let any values material go unattended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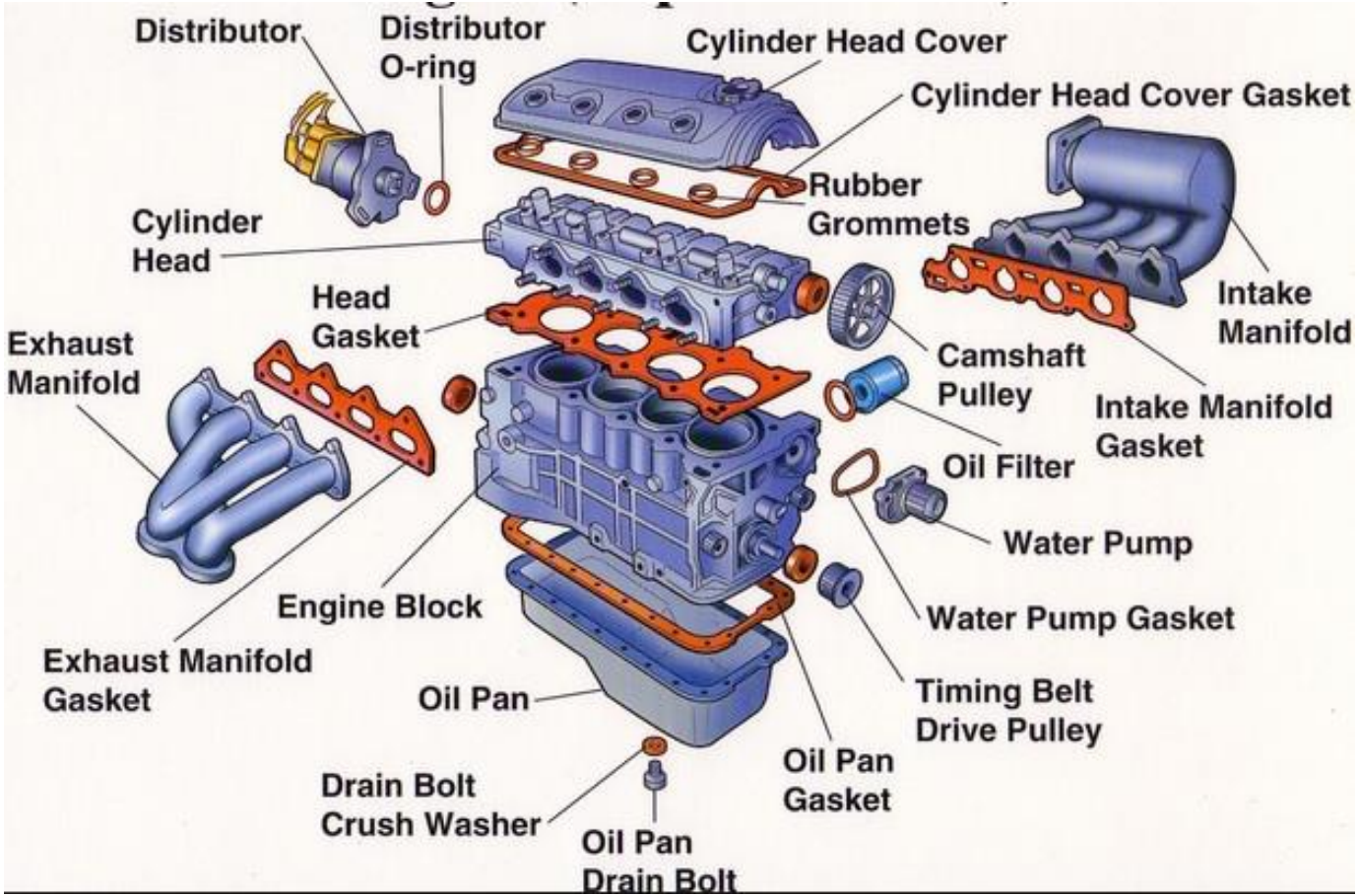
Distributor
Distributor O-ring
Cylinder Head Cover
Cylinder Head Cover Gasket
Rubber Grommets
Cylinder Head
Head Gasket
Exhaust Manifold
Intake Manifold
Camshaft Pulley
Intake Manifold Gasket
Oil Filter
Water Pump
Water Pump Gasket
Engine Block
Exhaust Manifold Gasket
Oil Pan
Timing Belt Drive Pulley
Oil Pan Gasket
Drain Bolt Crush Washer
Oil Pan Drain Bolt


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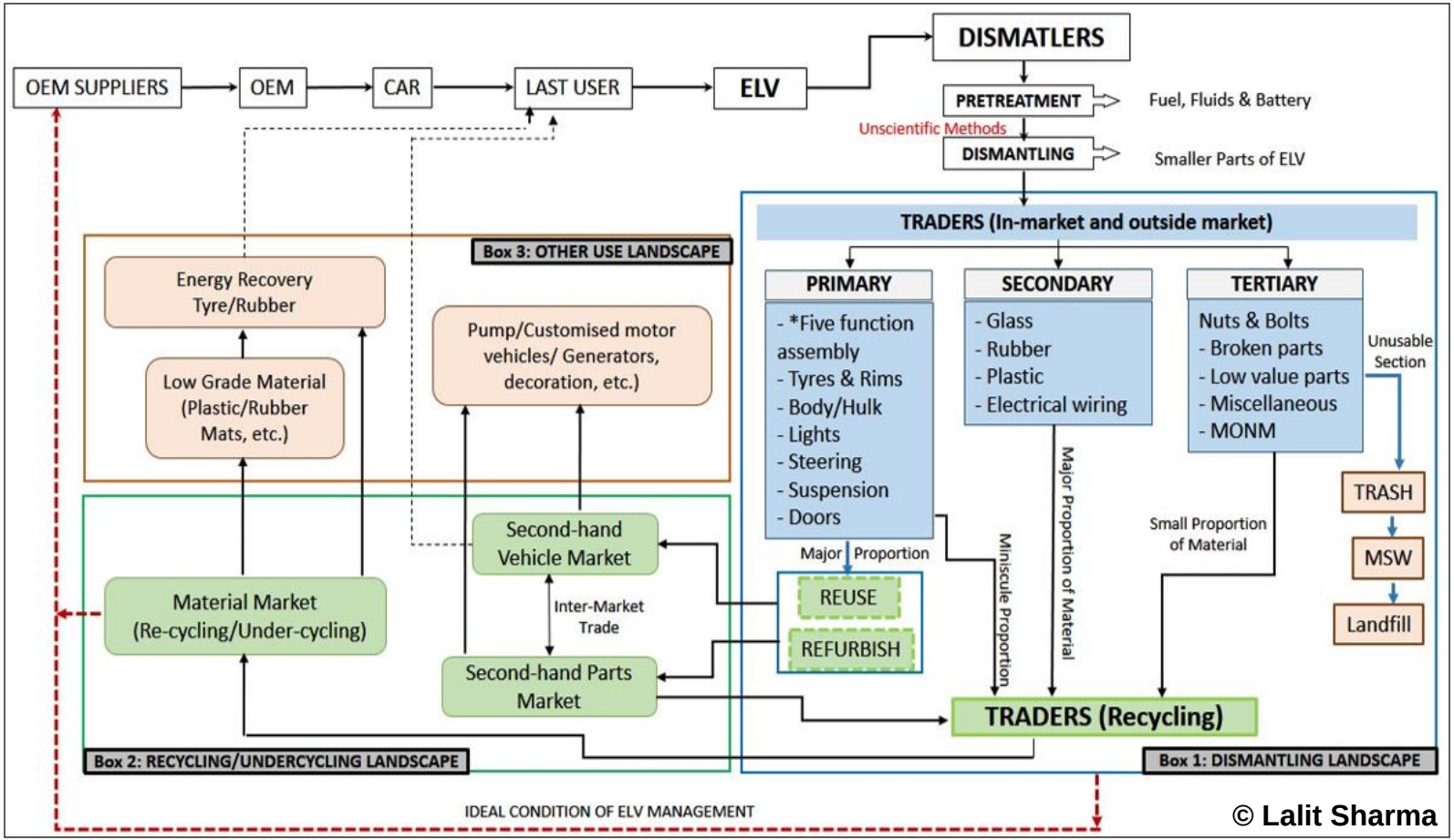

Current state of the informal automotive recycling and dismantling industry in India: Mayapuri ELV cycle (* a general term for the engine, front and back bridges, accelerator pedal, direction gear, and chassis)


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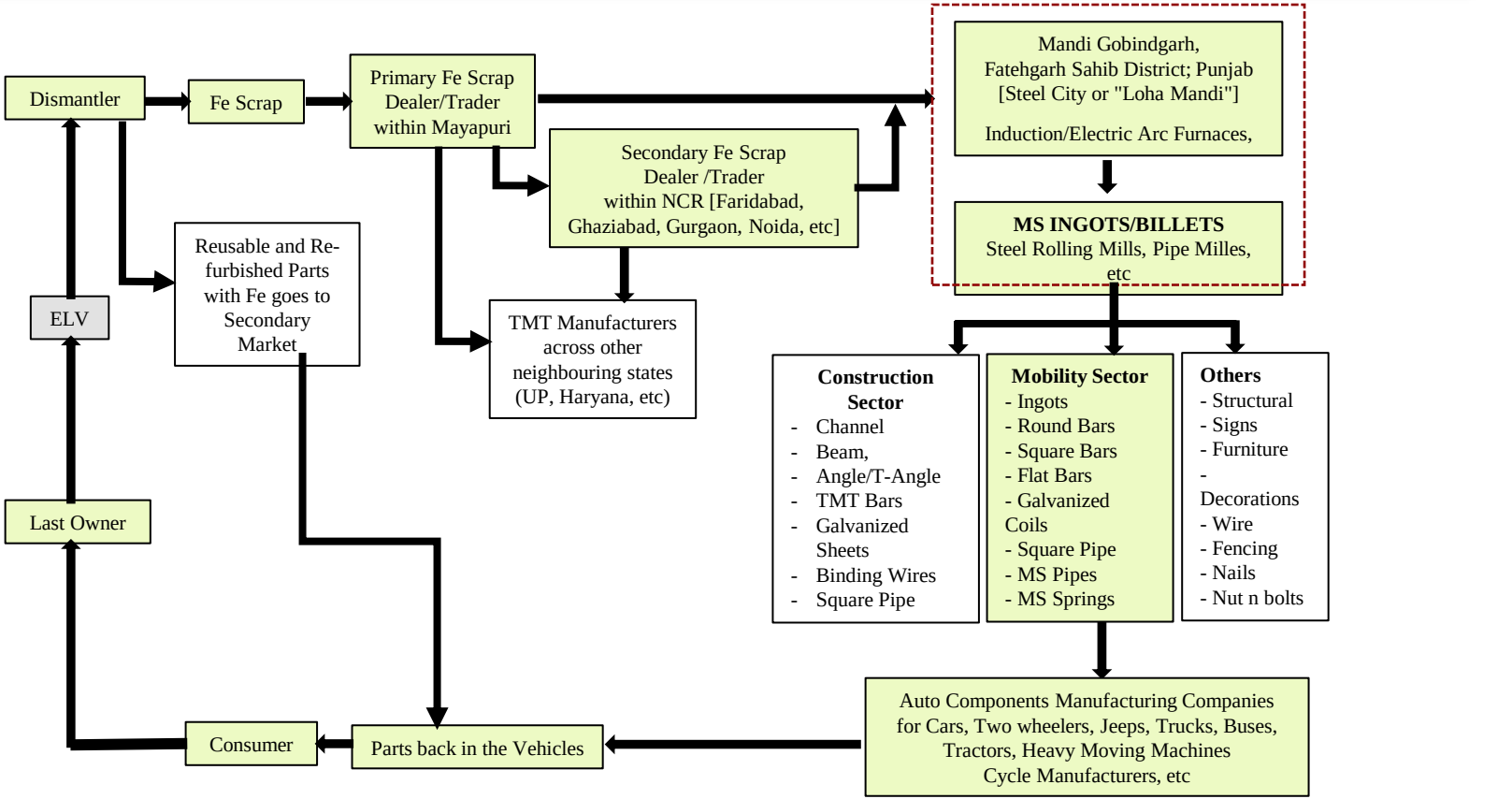
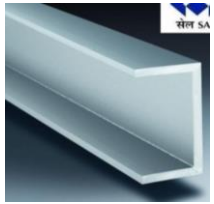
Case Example: Material Flow Chart of Iron (Fe) generated from ELV's, towards its downstream

Snapshot from Indian informal ELV market and Challenges associated



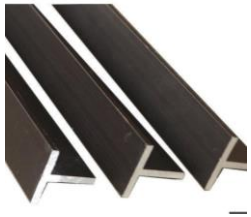
Construction Sector



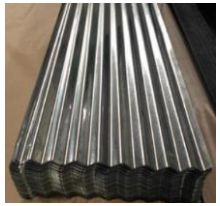
Channels

Beam

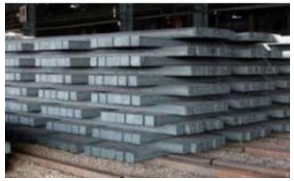
Angle



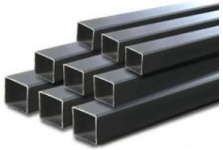
T-Angle



Galvanized Corrugated Sheets



Billets



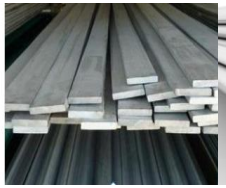
Square Pipe

Binding Wire

Mobility Sector

Ingots

Square/Round Bars



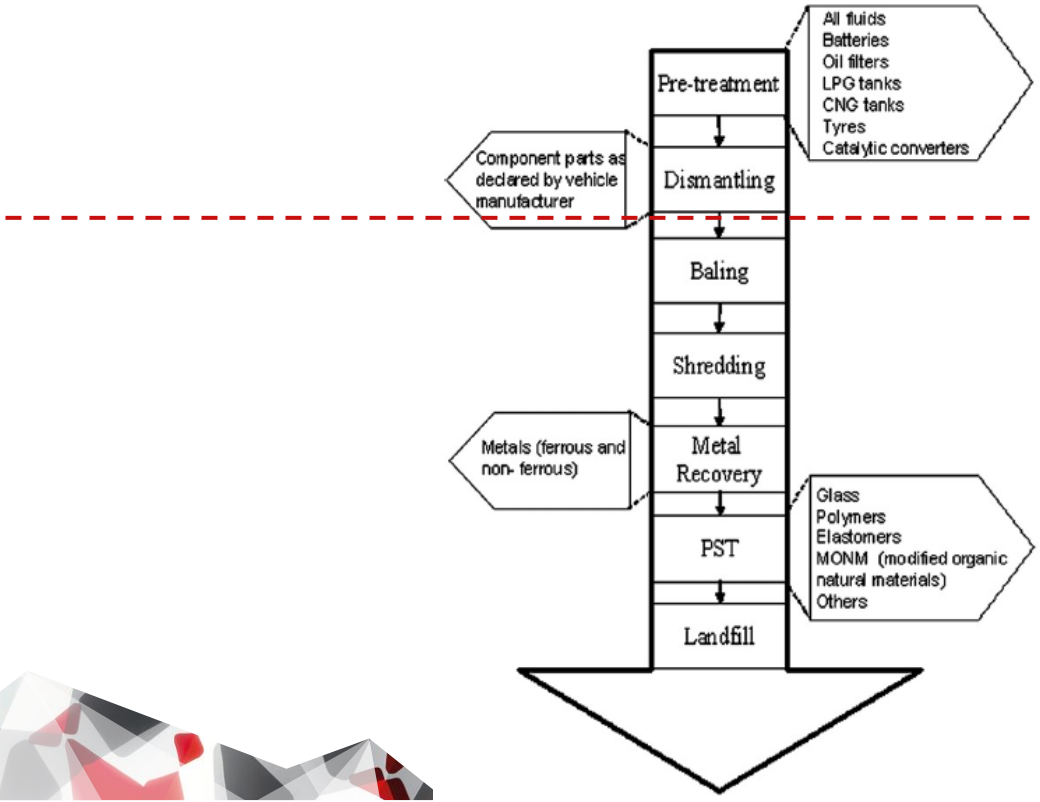
Flat Bars

MS Pipes

MS Springs

Galvanized Coils

ELV Management: Where does India stands as per ISO



ELV supply chain according to ISO 22628 (International Organization for Standardization, 2002). (Source: Morselli, Santini, Passarini, & Vassura, 2010)

SRM is better than Virgin material

LEARNINGS

- Steel from primary ore uses two and half times more energy than steel produced from melting scrap

- One tonne of steel through (EAF electric arc furnaces route) consumes 9–12.5 GJ/tcs whereas the BOF basic oxygen steel making furnaces or open hearth furnaces (OHFs) steel consumes 28– 31 GJ/tc **[72% of energy expended in BF itself]**

- Making EAF production of steel much more environmentally sensitive compared to the BOF route.

(Yellishetty, Mudd, Ranjith, & Tharumarajah, 2011)

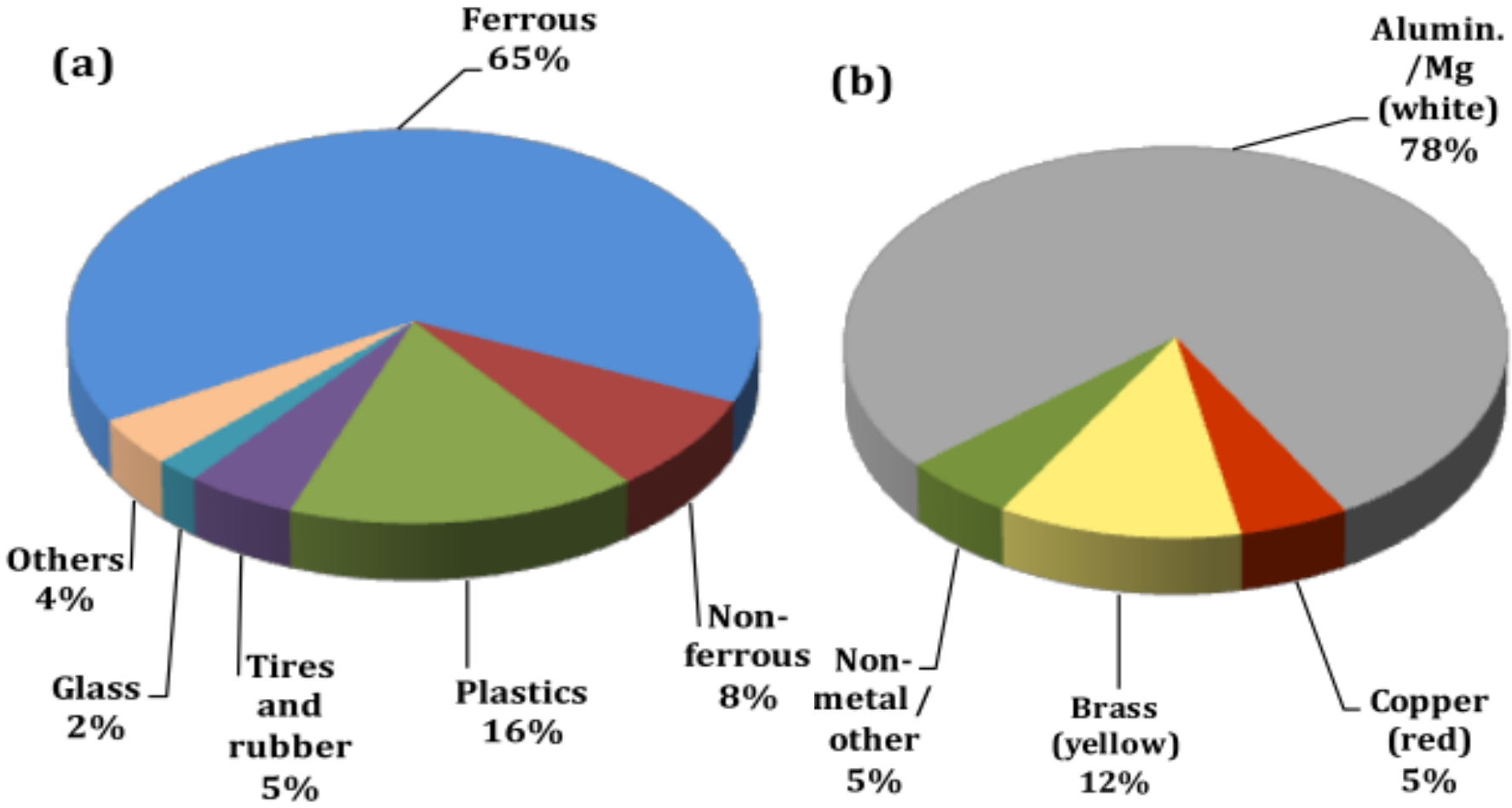
- Energy to produce 1 metric ton of stainless steel is 79 GJ with CO_2 releases totalling to 5.3 metric tons.

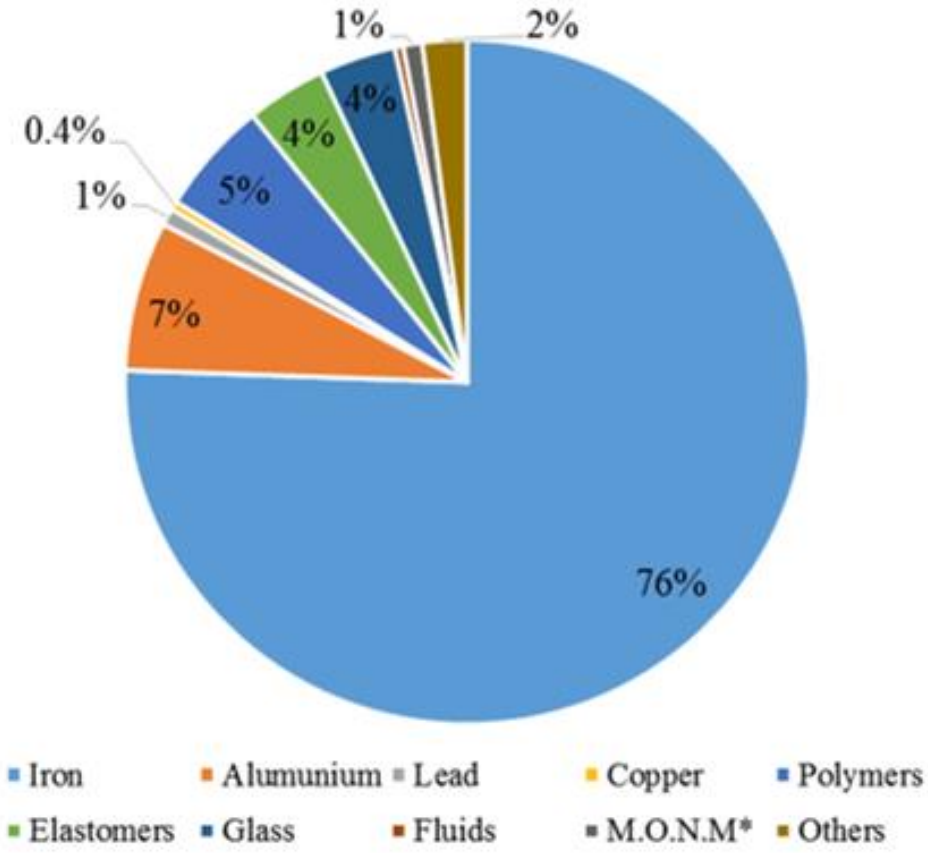
  If this were to be produced from scrap, energy use would be 67% less and CO_2 emissions would be cut by 70%.

(Johnson, Reck, Wang, & Graedel, 2008)

Composition of fractions (wt%) in auto-shredder facilities:

(a) overall (b) non-ferrous fraction (Source:Margarido et al., 2014)





Modified Organic Natural Materials (MONM), as leather, wood, cardboard and cotton fleece;

Mass characterization of a hatchback ELV sample- India

Table : Quantities (mass in kilograms) of different components and the rates of recycling and recovery recorded after dismantling of five samples vehicles at the end of their life.

Sample number	Pre-treatment mass (m_P)	Dismantling mass (m_D)	Metal separation mass (m_M) (hulk mass)	Non-metallic residue treatment mass (m_{Tr}/m_{Te})	Potential energy recovery mass (m_{Te})	Initial mass of ELV (m_V)	Recyclability rate (R_{cyc})	Recoverability rate (R_{cov})
Sample 1	20.5	258	226	51.5	16	625	90%	91%
Sample 2	68.5	300.5	275	68	26	780	91%	95%
Sample 3	23.5	296	273	57.5	22	734	88%	91%
Sample 4	23	309	305	63.5	23.5	805	87%	90%
Sample 5	22	276	265	51.5	18.5	695	88%	91%
						Average	88.8%	91.6%

Automotive Industry Standard AIS-129

On behalf of

AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE set under

CENTRAL MOTOR VEHICLE RULES

a

TECHNICAL STANDING COMMITTEE was set up by

MINISTRY OF ROAD TRANSPORT & HIGHWAYS (DEPARTMENT OF ROAD TRANSPORT & HIGHWAYS) GOVERNMENT OF INDIA in March 2015

Follows:

- ISO 22628:2002 (E): Road Vehicles – Recyclability and recoverability – Calculation Method
- IS 9211 : 2003 : Terms and definitions of Road Vehicles

SIAM: Considering the need to formulate the standard, tremendous effort was made by SIAM to formulate a regulation for the safe disposal of ELVs and reduction of heavy metals in the vehicles

ANNEX-C

DATA PRESENTATION

The data for the calculation shall be reported using the following table, either on paper or in electronic form (the materials breakdown section is optional)

Table C.1- Presentation of Data for M1 category vehicles

Brand Name				Vehicle Mass (kg), m_V			
Model (type /variant)							
Material Breakdown (mass in kg)	Metals	Polymers (excluding elastomers)	Elastomers	Glass	Fluids	M.O.N.M	Others
Pretreatment (m_p)						Mass (kg)	
	Fluids			m_{p1}			
	Battery			m_{p2}			
	Oil filters			m_{p3}			
	L.P.G. Tanks			m_{p4}			
	C.N.G. Tanks			m_{p5}			
	Tyres			m_{p6}			
	Catalytic converters			m_{p7}			
				m_p total (sum m_{p1} to m_{p7})			
Dismantling (m_D)							
Sr. no.	Part name	Mass (kg)	Sr. no.	Part name	Mass (kg)	Mass (sr. no. 11 to x) (kg)	
1			6			m_{D1} total (sum 11 to x)	
2			7			Please add separate list for sr. no. 11 to x	
3			8				
4			9				
5			10				
m_{D1} total (sum 1 to 5)			m_{D2} total (sum 6 to 10)			m_D total (m_{D1} total + m_{D2} total+m_{Dx} total)	
Metal Separation (m_M)		Remaining metal content of the vehicle				**Mass (kg)**	
						m_M total	
Non-metallic residue treatment (m_{Tr} and m_{Te})		**m_{Tr} = recyclable material**				Mass (kg)	
		Technology no.	Name				
		1		m_{Tr1}			
		2		m_{Tr2}			
		3		m_{Tr3}			
		4 to x		m_{Trx}			
		Please add separate list for technologies 4 to x				m_{Tr} total (sum m_{Tr} to m_{Trx})	
		m_{Te} = energy recoverable materials				**Mass (kg)**	
		Remaining quantity of organic materials (polymers, elastomers, MONM etc)				m_{Te}	
	Recyclability rate	Rcyc (%) = $((m_p+m_D+m_M+m_{Tr})/m_v)*100$					
	Recoverability rate	Rcov (%) = $((m_p+m_D+m_M+m_{Tr}+m_{Te})/m_v)*100$					

NOTE:

Final results, in percentage shall be an integer (whole number).For the purpose of rounding off IS 2:1960 'Rules for rounding off numerical values' as amended from time to time, shall be used.

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Recovery of resources from end-of-life passenger cars in the informal sector in India

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ABSTRACT

Sustainable management of vehicles at their end-of-life stage (ELVs) offers a significant potential for resource recovery by closing the material loop and thus contributes to dealing with scarcity of resources. Although ELVs till date in countries like India are considered as waste and not as secondary resource material (SRM), but, if used judiciously, may obviate the extraction of primary or virgin materials. Although policymakers have focused on ways to ensure higher resource efficiency in the automobile sector, research on the role of the informal sector in recovering useful materials and parts from ELVs is limited. The present study examines the current situation of ELV processing at Mayapuri scrap market, one of the largest informal markets for ELVs in Asia wherein, mass-balance approach is used to examine how hatchback cars are disposed. A conceptual framework depicting process flow and the interactions between the multiple stakeholders involved in this sector has been developed. Further, approximately 7% of aluminium and 76% of iron, by weight, were recovered from the sampled hatchback cars. These results were used for estimating the potential to recycle and to recover useful materials from ELVs that are processed by the informal sector in India. Under the business-as-usual scenario, the estimates show that the sector can recover about 0.34 million tonnes of aluminium and 4.03 million tonnes of iron by 2030. These figures

Link to Paper:-

Recovery of resources from end-of-life passenger cars in the informal sector in India - ScienceDirect

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CPCB Guidelines for ELV in India (2016)

- 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 key stakeholders (manufacturers, dealers, consumers, recyclers)

- The policy should address
  - Shared Responsibility involving all stakeholders
  - Mechanism for ELV Declaration, Deregistration, Destruction Certification and Transportation to Authorized Recyclers
  - Authorization & Registration of Recyclers processing ELV

- Environmentally sound management of ELVs needs to be regulated by Ministry of Environment Forests & Climate Change along lines of other post-consumer waste streams.

- A key building block of the proposed framework (not covered under the AIS 129), is the introduction of **'Extended Producer Responsibility'** which would have to be embedded within a **'Shared Responsibility'** Framework with clear roles for public sector as well.

Concluding Remarks

- 99% by Informal Sector
- Unscientific and crude methods of dismantling and handling of ELVs and parts
- **Depollution is absolutely neglected** (most critical steps as per ISO 22628) **and this is the step which keeps informal sector under regulatory radar.**
- Most of it, including fuel and engine oil, spill on the ground **although it's only ~ 1.5% of total ELV mass,** but contributes a great deal to environmental contamination
- Pace of vehicular increase does not match with pace of infrastructure development
- **Many rare earth elements lost** because they get mixed with iron during in smelting
- **Scrap Policy** (if implemented by April 2022) **5 mill (50 lac) vehicles will become ELV**
- Increasing number of ELVs imposes additional pressure, **hence, give them more reasons TO-DO-WHAT-THEY-DO**
- **Lack of inventory/good quality data** has been an obstacle for regulators, researchers and even OEMs (who might take back the sorted materials, but don't encourage dealing with them)
- Slow & labor-intensive operation can only tackle very small portion of overall ELV burden

Concluding Remarks

- **Sector is also used for dismantling stolen vehicles** (number is very small) it allows the selling of spare parts obtained from stolen and unaccounted ELVs as counterfeit goods, **therefore, raids by the police** are common which **brings overall sector under threat**
- Lack of **acknowledgement/acceptance of the mere existence of this sector,** is threat.
- **Craftsman in themselves, but can't flourish anymore like this**

Personal Opinion as Researcher;Lalit: Following some initiative from developed world, India can customize overall ELV management as per country specific situations (indeed with ambitious goals in terms of recovery, reuse and recycling of ELVs)

They have huge potential to favorably contribute to the overall ELV management.

Evident from few studies that manual dismantling brings additional benefit in recovering resources:-

(i) Car seats play an important role in the generation of ASR because they are the main source of Polyurethane Resins (PUR) and textiles, accounting for more then 20% in weight of the total ASR, hence can be saved,

(ii) by removing bumpers, tires, fuel tank and glass total ASR weight in a case study decrease about 30% hence increased recycling rate upto 7% .

Kuşakcı, A.O., Ayvaz, B., Cin, E. and Aydın, N., 2019. Optimization of reverse logistics network of End of Life Vehicles under fuzzy supply: A case study for Istanbul Metropolitan Area. *Journal of cleaner production*, *215*, pp.1036-1051.

Santini, A., Herrmann, C., Passarini, F., Vassura, I., Luger, T. and Morselli, L., 2010. Assessment of Ecodesign potential in reaching new recycling targets. *Resources, Conservation and Recycling*, *54*(12), pp.1128-1134.

Concluding Remarks

- **Even world with Directives/Regulation are struggling with ASR** in overall ELV Management
- To treat ASR further, there is **huge cost involved within Shredder and in PST**
- **Shredders is an century old phenomena** and needs major transactions (which has initiated)
- **Regularised word** is also looking towards the **Intensive Dismantling before Shredder**
- **What worked in EU/Japan, may not work in India-China-Istanbul-Philippines**, so the directives must be Judicious and Responsible to cater domestic demands.
- Dismantlers (after they abide with De-pollution) from overall informal value chain can be supported with proper training, recognition, pilot setups on PPT basis, as done in E-Waste Sector.
- **EPR can be one option for the new vehicles**
- **OEM's shall be encouraged for putting systems in place for Design to Recycle** (DtR), Design to Dismantle (DtD) and bringing further aspects of Eco-desigh
- Results of few studies presented shows they can reduce ASR quantum
- CPCB Guidelines-deliberations from two days – **Shared Responsibility can be one way out**
- **If it can not start now in India, it will be too late as there is conducive situations created by current government** for initiating start-ups, Pradhan Mantri Jan Dhan Yojana, Auto Mission Plan 2016–2026 Scrap Policy, etc

- ✓ **ELV waste stream is potential SRM and that's one way to tackle Global Resource Scarcity (via CE), if we bring them back into value chain judiciously and CAR@EoL still gives you a lot ☺ ☺**
- ✓ **Craftsman in themselves, but can't flourish anymore like this**

Thanks for being wonderful audience…!

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