FC

Ciências
ULisboa

Faculdade
de Ciências
da Universidade
de Lisboa

Eng Energy & Environment

Environmental Impact & LCA

Ciências ULisboa

CHALENDGE #2

27 de Setembro (terça-feira) 14h40 e as 15h40

valorcar
valorizamos o ambiente

Pedro Pinto
Departamento Técnico

CHALENDGE #2

11 de Outubro (terça-feira) 14h40 as 15h40

Paulo Silva
Departamento Logistica

ELV – End-of-Life Vehicle

https://ec.europa.eu/eurostat/statistics-explained/index.php?title=End-of-life_vehicle_statistics&oldid=555195

Reuse/recovery rate and reuse/recycling rate for end-of-life vehicles, 2019

EU totals estimated by Eurostat.

2018 data for Romania and Malta; 2017 data for Iceland.

Countries are ranked in decreasing order by reuse/recovery rate for end-of-life vehicles.

Source: Eurostat (online data code: env_waselvt)

eurostat

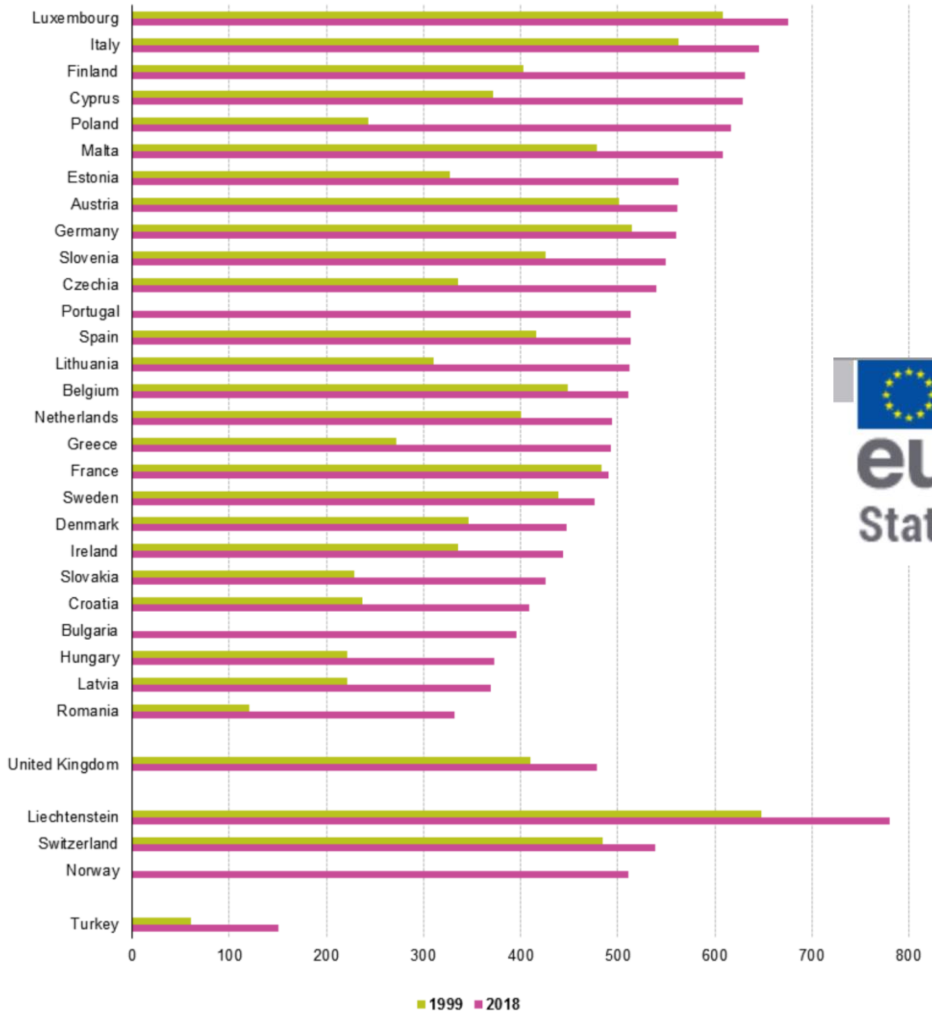
ELV – End-of-Life Vehicle

6.1 million passenger cars, vans and other light goods vehicles were scrapped in the EU in 2019.

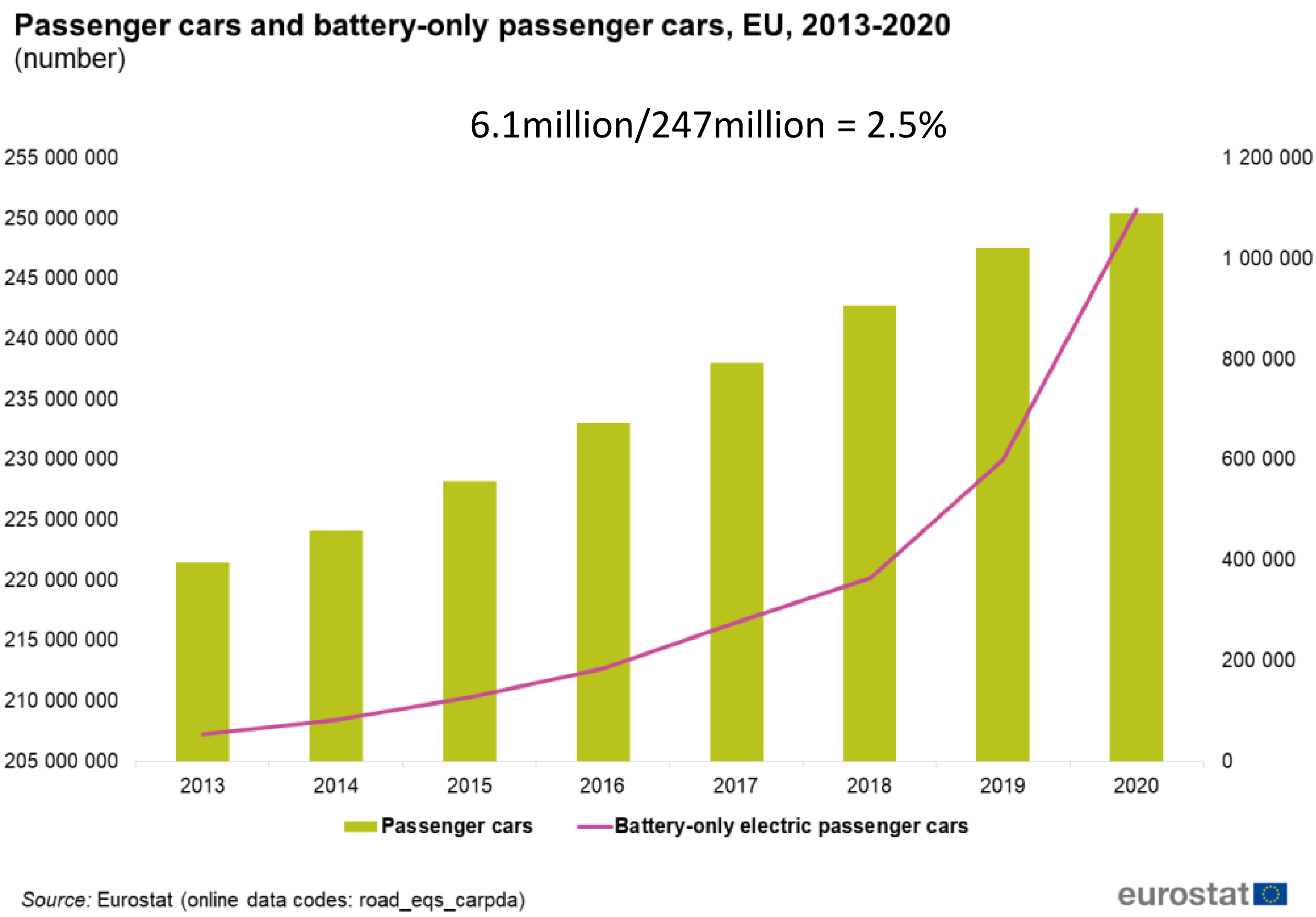
The total weight of passenger cars, vans and other light goods vehicles scrapped in the EU in 2019 was 6.9 million tonnes; 95.1 % of the parts and materials were reused and recovered, while 89.6 % were reused and recycled.

ELV – End-of-Life Vehicle

Number of passenger cars per thousands inhabitants, 1999 and 2018



ELV – End-of-Life Vehicle



ELV – End-of-Life Vehicle

In PT

INSTITUTO NACIONAL DE ESTATÍSTICA
STATISTICS PORTUGAL

Estatísticas Produtos WebInq EN Pesquisa

Início / Produtos / Base de Dados

Principais indicadores | Principais quadros | Base de dados | Microdados | Estatísticas territoriais | Pirâmides etárias

> Incluir/retirar indicadores > Alterar condições de seleção > Alterar formato do quadro > Visualizar quadro

Veículos rodoviários motorizados (N.º) por Tipo de veículo e Tipo de combustível; Anual (2)

Período de referência dos dados	Localização geográfica	Tipo de veículo (1)	Tipo de combustível								
			Total	Gasóleo	Gasolina	GPL	Biodiesel	Elétrico puro	Elétrico híbrido plug-in	Elétrico híbrido não plug-in	Outros
			N.º	N.º	N.º	N.º	N.º	N.º	N.º	N.º	N.º
2020	Portugal	Total	8 349 381	4 616 541	3 543 690	59 445	x	33 749	31 007	61 415	3 534
		Ligeiros	6 888 903	4 455 538	2 252 823	59 366	x	28 191	30 990	61 324	671
		Passageiros	5 565 963	3 146 222	2 241 224	58 717	x	26 949	30 990	61 308	553
		Mercadorias	1 290 390	1 277 133	11 300	600	x	1 231	-	15	111
		Outros	32 550	32 183	299	49	x	11	-	1	7
2019	Portugal	Total	8 312 469 *	4 630 570	3 529 717	58 354	x	24 090	17 543	48 893	3 302 *
		Ligeiros	6 880 725	4 455 127	2 281 311	58 253	x	19 144	17 526	48 794	570
		Passageiros	5 452 119	3 044 926	2 264 850	57 432	x	18 139	17 526	48 787	459
		Mercadorias	1 396 653	1 378 708	16 070	768	x	997	-	6	104
		Outros	31 953	31 493	391	53	x	8	-	1	7
2018	Portugal	Total	7 940 894	4 389 665	3 430 293	56 975	x	14 267	9 716	37 038	2 940
		Ligeiros	6 576 883	4 232 739	2 229 599	56 878	x	10 580	9 699	36 962	426
		Passageiros	5 282 970	2 952 260	2 217 506	56 213	x	9 980	9 699	36 960	352
		Mercadorias	1 267 647	1 254 562	11 799	620	x	598	-	1	67
		Outros	26 266	25 917	294	45	x	2	-	1	7
2017	Portugal	Total	7 632 238	4 202 852	3 334 624	53 064	x	7 938	4 611	28 246	903
		Ligeiros	6 325 855	4 053 217	2 181 634	52 969	x	5 050	4 594	28 177	214
		Passageiros	5 059 472	2 800 640	2 168 924	52 315	x	4 667	4 594	28 175	157
		Mercadorias	1 240 914	1 227 464	12 405	611	x	383	-	1	50
		Outros	25 469	25 113	305	43	x	-	-	1	7
2016	Portugal	Total	7 346 719	3 992 595	3 275 659	50 051	x	4 877	1 804	20 894	839
		Ligeiros	6 095 470	3 851 934	2 168 215	49 953	x	2 559	1 787	20 832	190
		Passageiros	4 850 229	2 619 720	2 156 073	49 301	x	2 383	1 787	20 830	135
		Mercadorias	1 221 913	1 209 213	11 861	609	x	176	-	1	53
		Outros	23 328	23 001	281	43	x	-	-	1	2
2015	Portugal	Total	7 181 598	3 846 175	3 265 059	48 856	x	3 381	687	16 580	860
		Ligeiros	5 970 710 *	3 705 936 *	2 197 082 *	48 752 *	x	1 531 *	672 *	16 529 *	208 *
		Passageiros	4 722 963 *	2 471 985 *	2 184 146 *	48 062 *	x	1 398 *	672 *	16 527 *	173 *
		Mercadorias	1 224 821 *	1 211 347 *	12 657 *	648 *	x	133 *	-	1 *	35 *
		Outros	22 926 *	22 604 *	279 *	42 *	x	-	-	1 *	-
		Total	7 155 962	3 773 590	3 316 275	47 810	x	2 387	219	13 284	2 397

ELV – End-of-Life Vehicle

In PT

ELV/Ligeiros de passageiros 2018 =107 209/5 282 970 = 2%
2019 =111 112/5 452 119 = 2%
2020 =101 378/5 565 963 = 2%

47 elétricos abatidos em 2021 (0,04%)

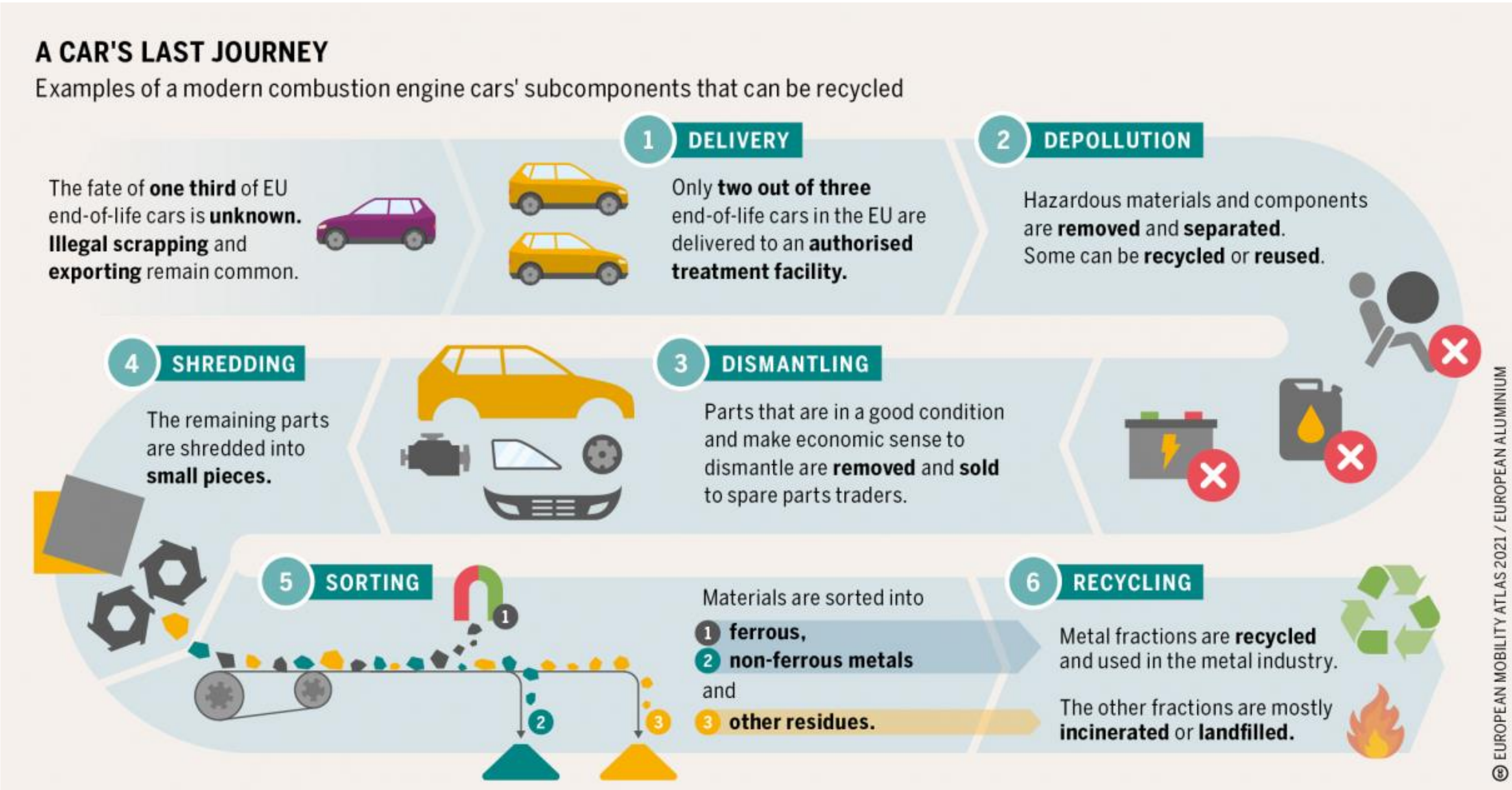
57 híbridos em 2021 (0,05%)

Diesel: 37,0%

Gasolina: 62,8%

valorcar

ELV – End-of-Life Vehicle



← ICS ← 13 ← 13.020 ← 13.020.10

ISO 14040:2006

Environmental management — Life cycle assessment — Principles and framework

13 CLIMATE ACTION

Abstract

Preview

ISO 14040:2006 describes the principles and framework for life cycle assessment (LCA) including: definition of the goal and scope of the LCA, the life cycle inventory analysis (LCI) phase, the life cycle impact assessment (LCIA) phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, the relationship between the LCA phases, and conditions for use of value choices and optional elements.

ISO 14040:2006 covers life cycle assessment (LCA) studies and life cycle inventory (LCI) studies. It does not describe the LCA technique in detail, nor does it specify methodologies for the individual phases of the LCA.

The intended application of LCA or LCI results is considered during definition of the goal and scope, but the application itself is outside the scope of this International Standard.

← ICS ← 13 ← 13.020 ← 13.020.10

ISO 14044:2006

Environmental management — Life cycle assessment — Requirements and guidelines

Abstract

Preview

ISO 14044:2006 specifies requirements and provides guidelines for life cycle assessment (LCA) including: definition of the goal and scope of the LCA, the life cycle inventory analysis (LCI) phase, the life cycle impact assessment (LCIA) phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, relationship between the LCA phases, and conditions for use of value choices and optional elements.

ISO 14044:2006 covers life cycle assessment (LCA) studies and life cycle inventory (LCI) studies.

LCA – Life Cycle Assessment

LCA framework

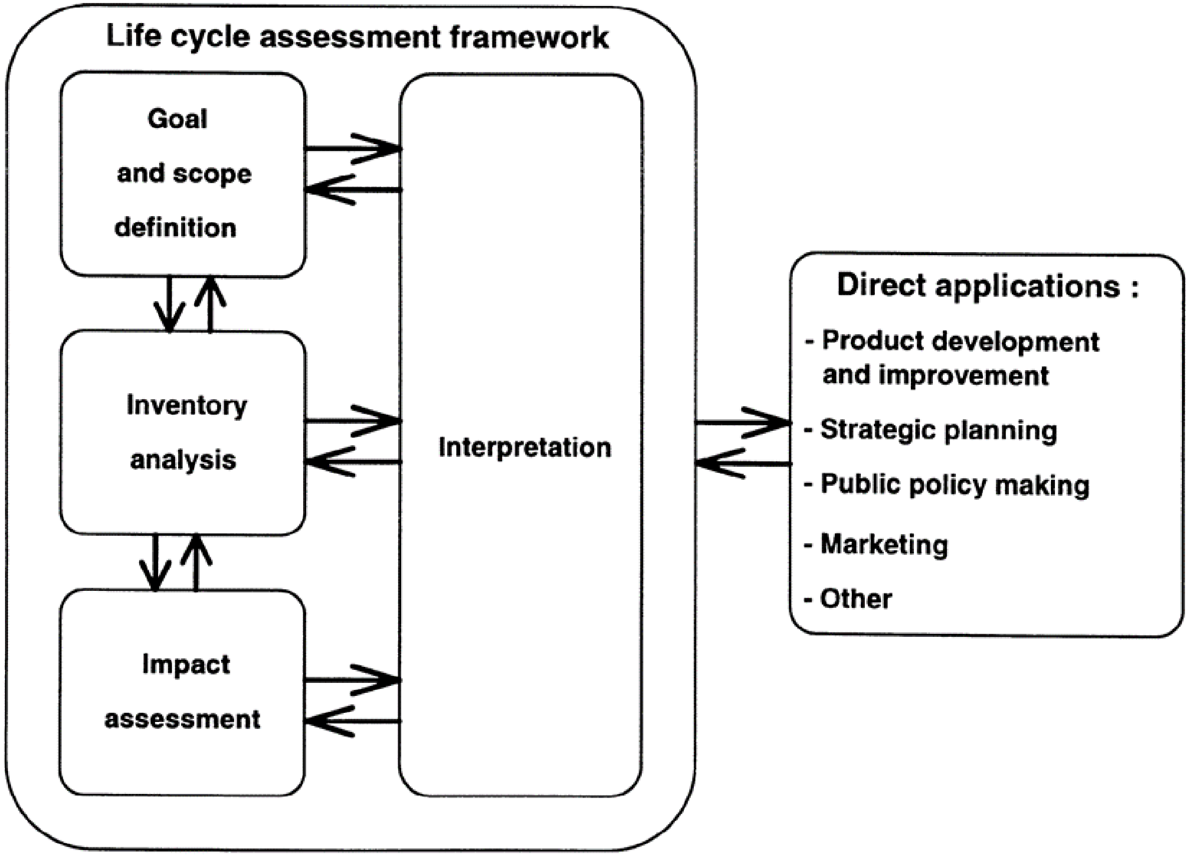


Figure 1 : Phases of an LCA

Source: ISO 14040

ELV – End-of-Life Vehicle

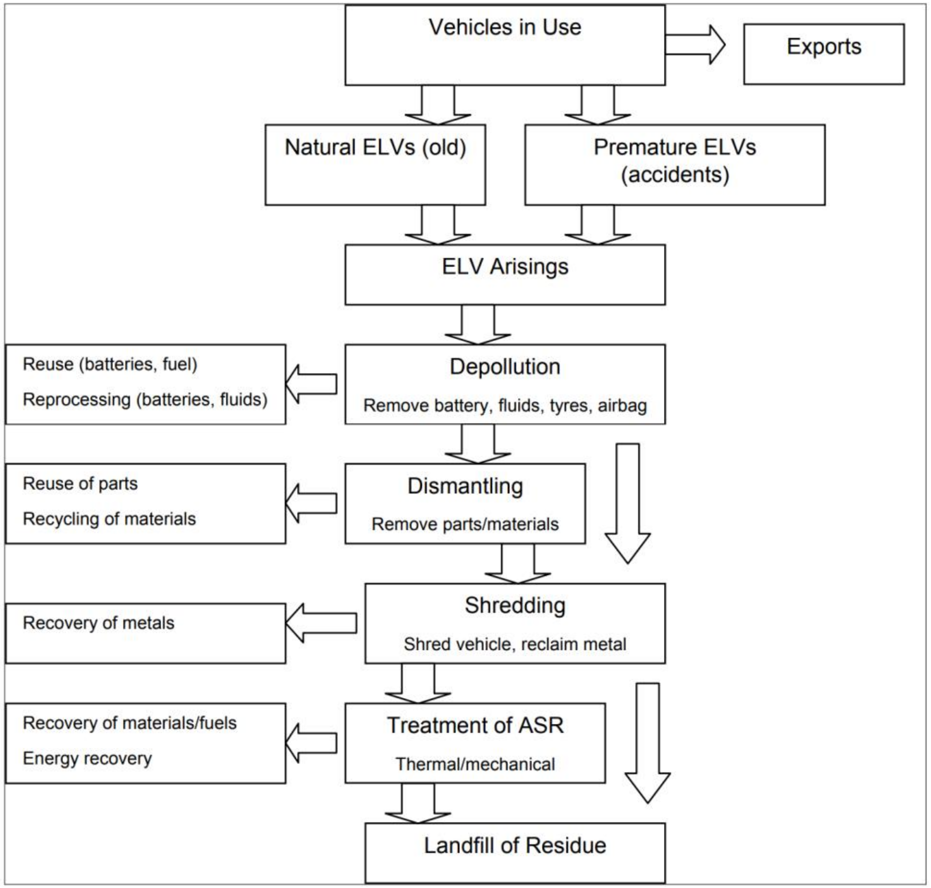
Goal & Scope:

Evaluate mass recovery rates, energy consumption (fossil and renewable) and CO_2eq emissions to the atmosphere of managing an ELV

ELV – End-of-Life Vehicle

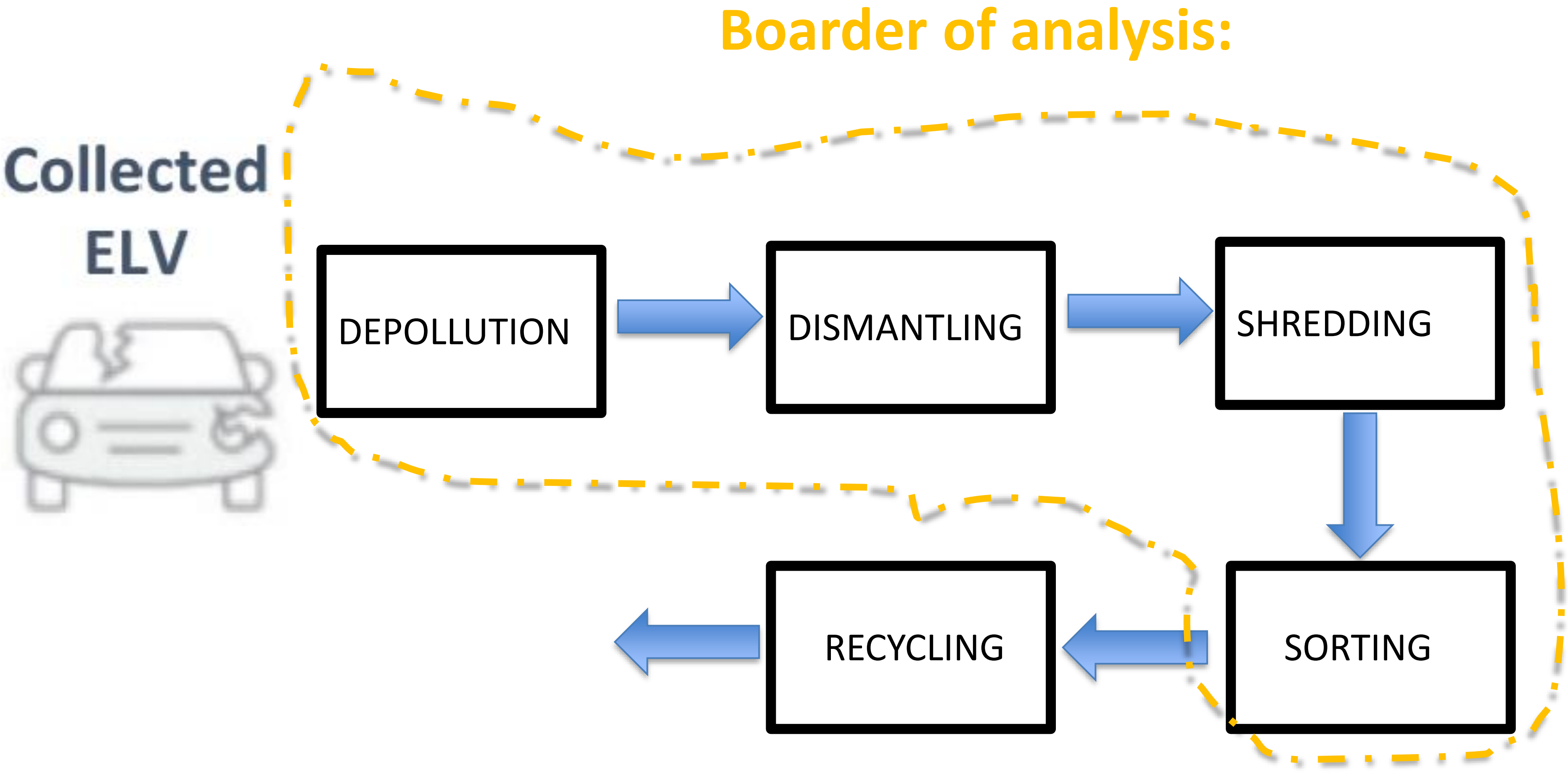
Collected ELV

Figure 1.2: Description of ELV Arisings and Treatment



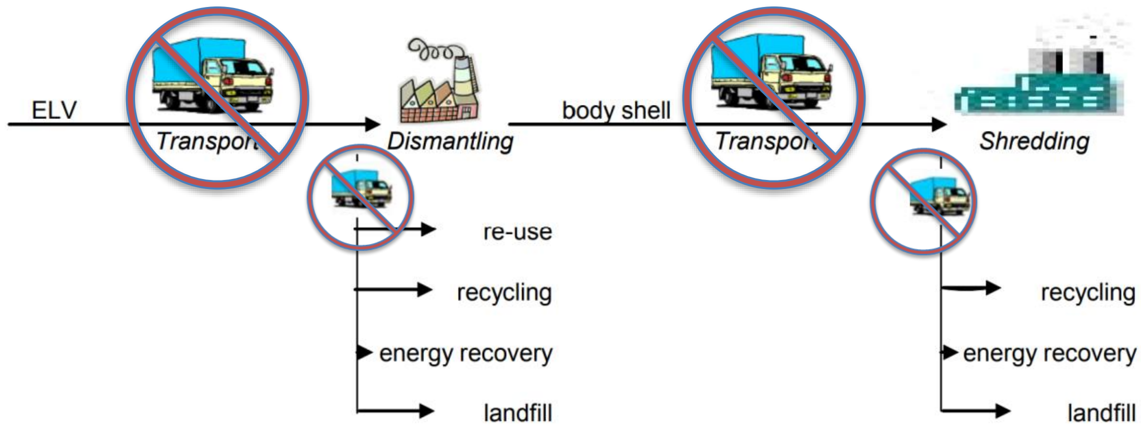
https://ec.europa.eu/environment/pdf/waste/study/final_report.pdf

ELV – End-of-Life Vehicle



ELV – End-of-Life Vehicle

Boarder of analysis:



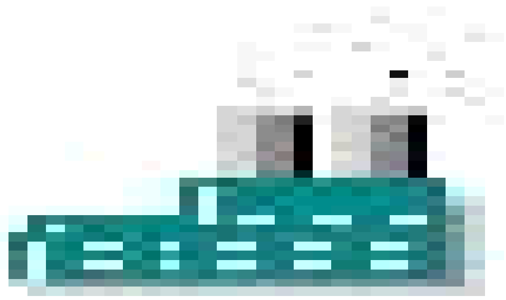
Transport between facilities not included

ELV – End-of-Life Vehicle

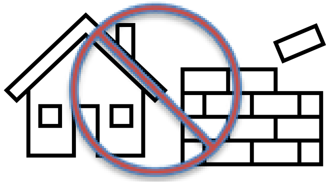
Boarder of analysis:

Collected ELV

Dismantling



Shredding



Construction materials of facilities not included, nor materials embedded in products used for manipulating the ELV

ELV – End-of-Life Vehicle

Collected ELV

Functional Unit (FU):

1 ton ELV

Results are expressed by 1 ton ELV

Chose the most appropriate Functional Unit (FU)?

Compare reading paper books versus use kindle from Amazon

e.g. 40 books

4 years kindle lifetime and 10 books a year

Chose the most appropriate Functional Unit (FU)?

Compare incandescent vs fluorescent lamp

e.g. working hours

Chose the lamp with the highest lifetime

Carla Silva camsilva@fc.ul.pt

ELV – End-of-Life Vehicle

Chose the most appropriate Functional Unit (FU)?

e.g. 1 passenger x 1 kilometer (pkm)

Chose the most appropriate Functional Unit (FU)?

Transport merchandise valid FU ton*km

Chose the most appropriate Functional Unit (FU)?

e.g. 1000 L of potable water delivered in 330 mL PET or glass containers

Chose the most appropriate Functional Unit (FU)?

e.g. 1 hair wash

VS

ELV – End-of-Life Vehicle

Functional Unit (FU):

1 ton ELV

Results are expressed by 1 ton ELV

ELV – End-of-Life Vehicle

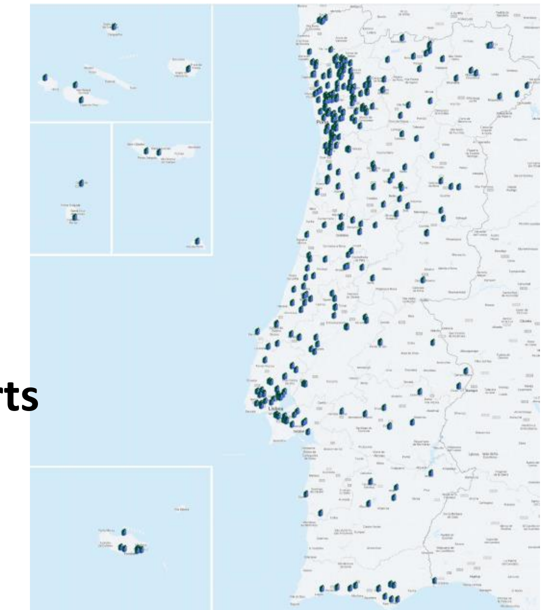
INVENTORY

DATA INTENSIVE

Mass flows;
Energy flows.

ELV – End-of-Life Vehicle

Visiting facilities (+300) and take notes, ask workers

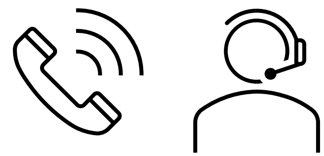


Networking

Dismantling

Shredding

Interviews to technical experts



Literature

SAE TECHNICAL PAPER SERIES

2008-01-1283

Constructing a Gate-to-gate Life Cycle Inventory (LCI) of End-of-Life Vehicle (ELV) Dismantling and Shredding Processes

Inventory per hair wash?

1.67 g/lavagem

vs

15 ml por lavagem

Case study

Âmbito/Scope: comparar lavar cabelo com líquido ou sólido considerando

FU-Functional unit/ unidade funcional: 1 lavagem

Materiais da embalagem (extração, produção, fim de vida)

Água da lavagem (uso)

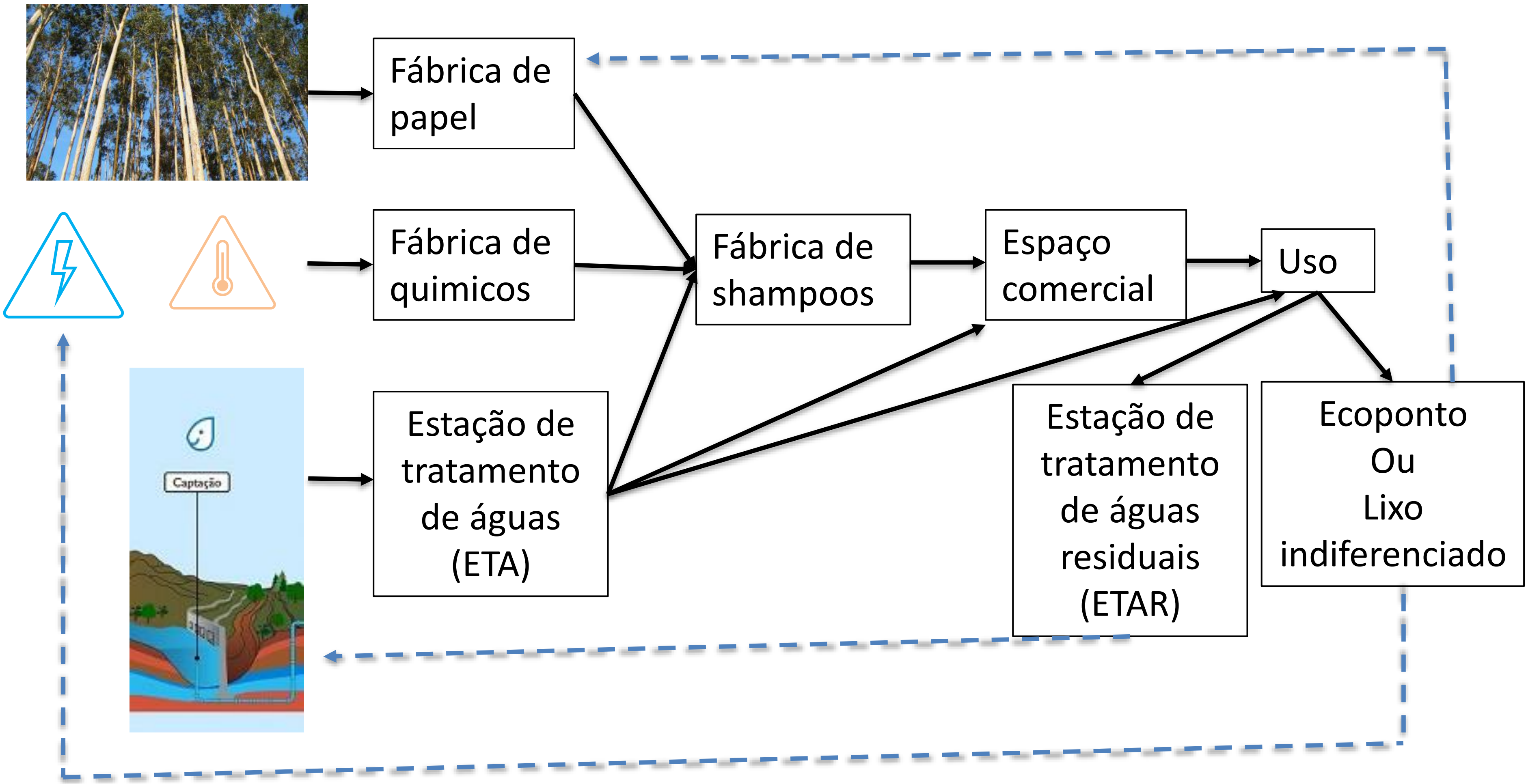
Gás natural e eletricidade (uso)

Químicos constituintes (extração, produção)

O que considerar??

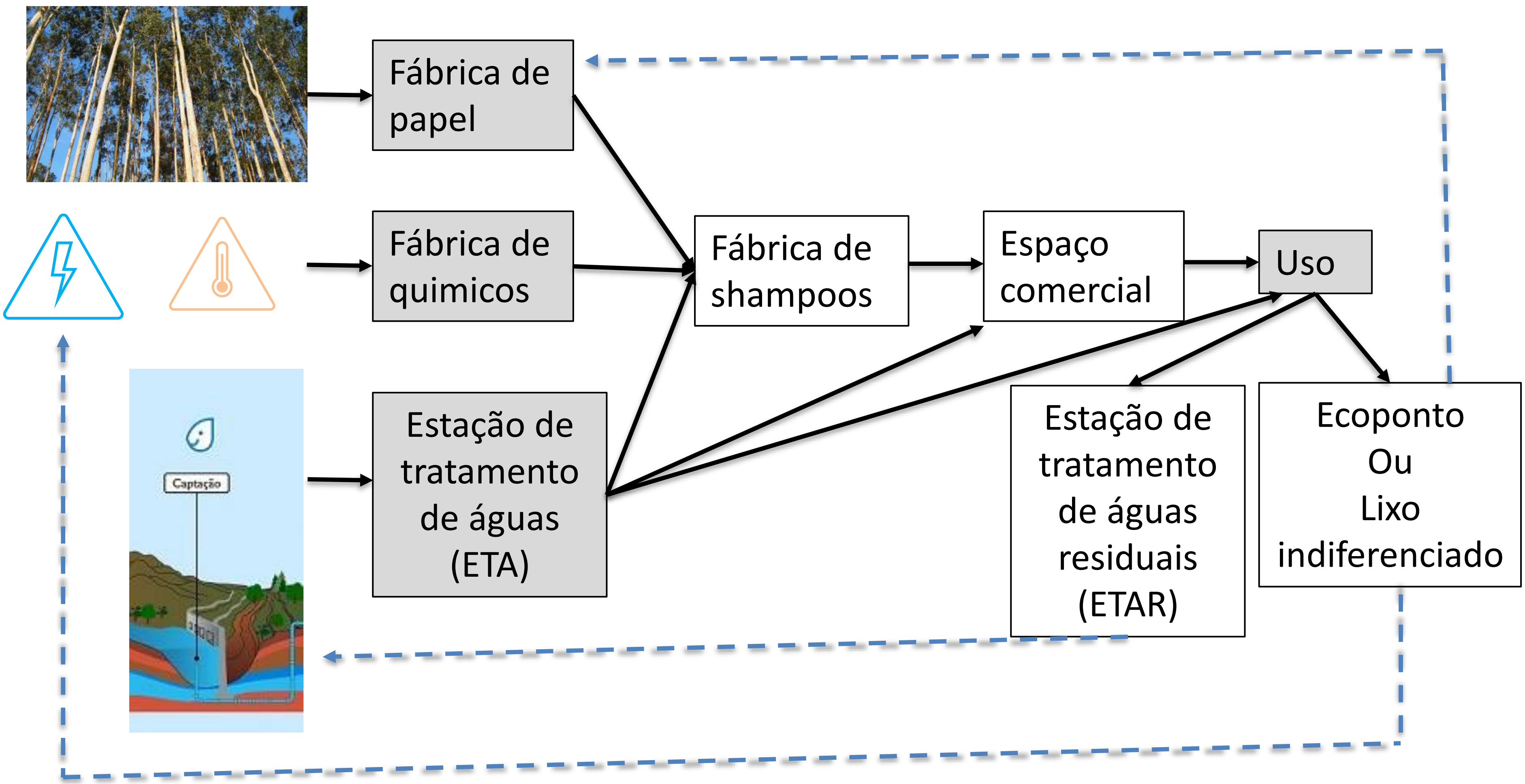
Case study

O que considerar?? – fronteira do estudo



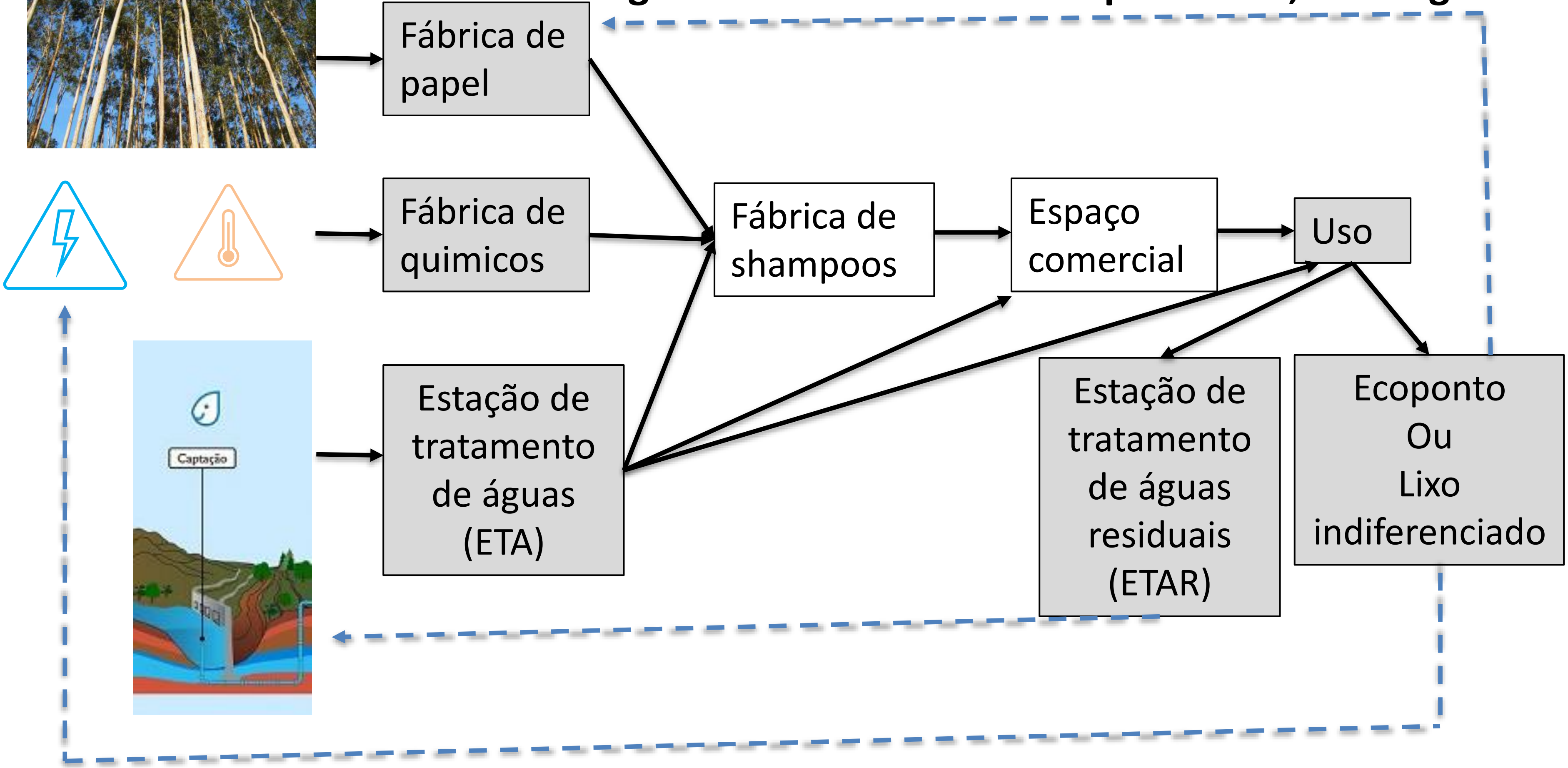
Case study

O que considerar?? – uso e fabrico da matéria prima



Case study

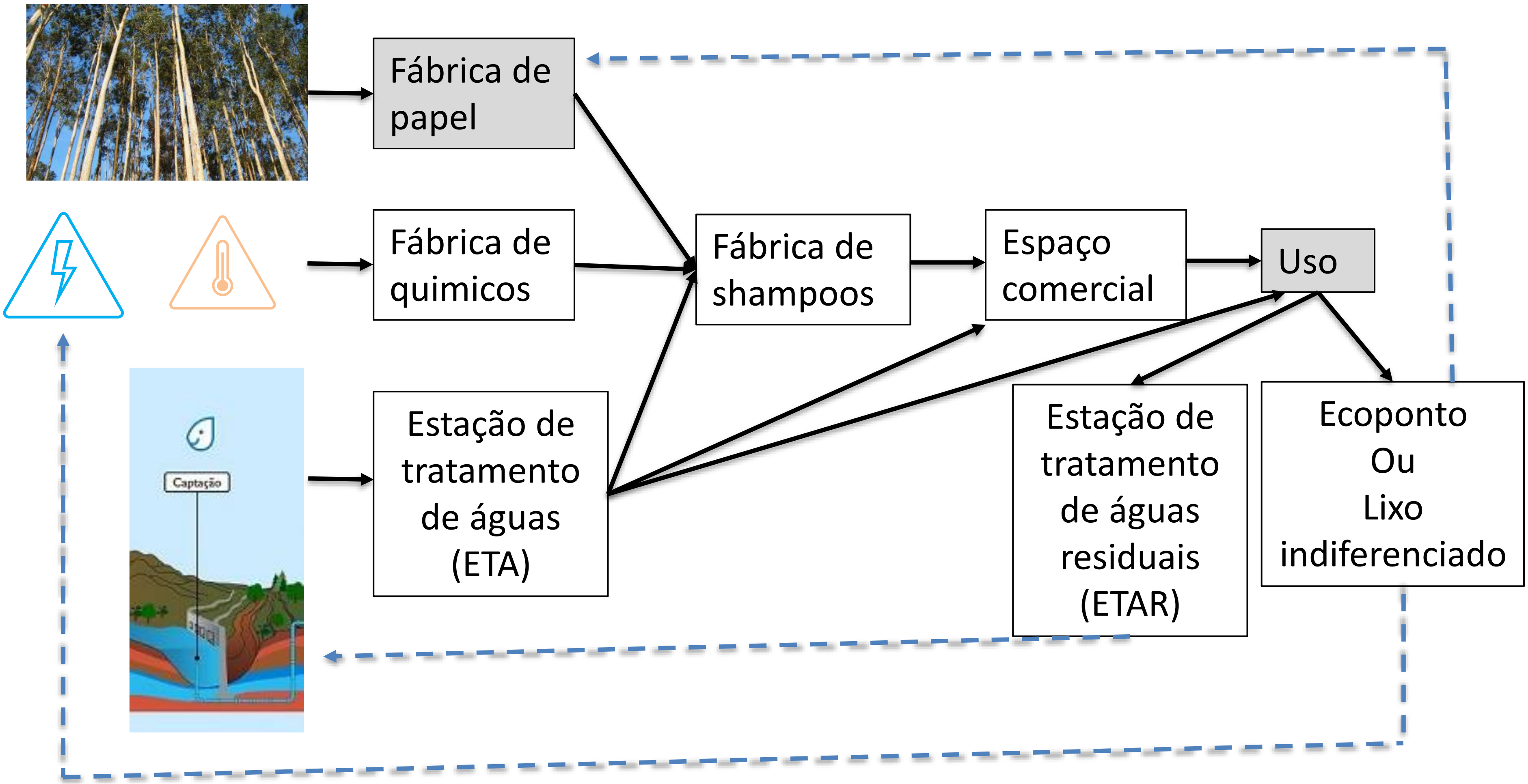
O que considerar?? – uso e fabrico da matéria prima e água consumida e enviada para ETAR, reciclagem



Carla Silva camsilva@fc.ul.pt

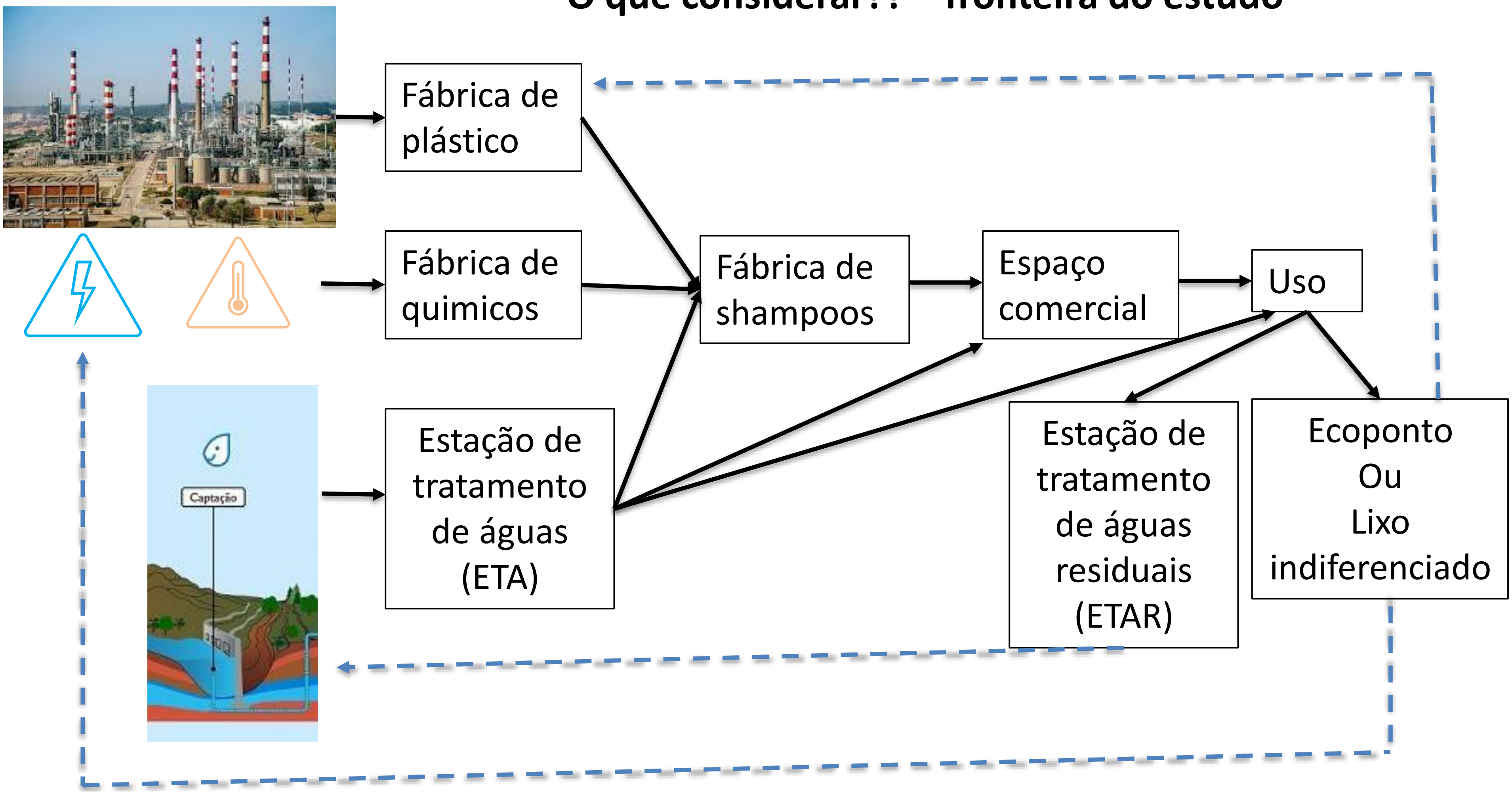
Case study

O que considerar?? – Produção embalagens



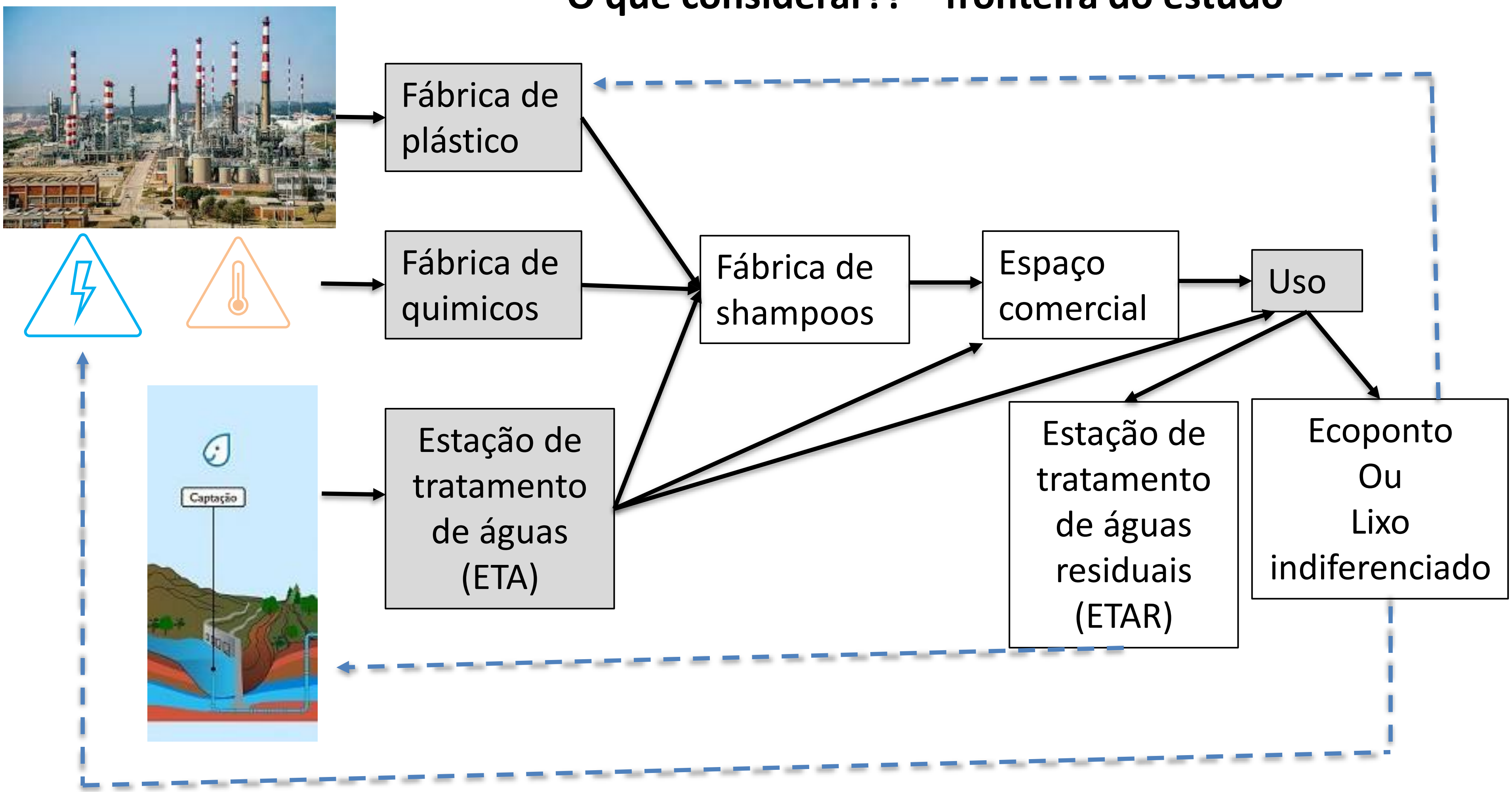
Case study

O que considerar?? – fronteira do estudo



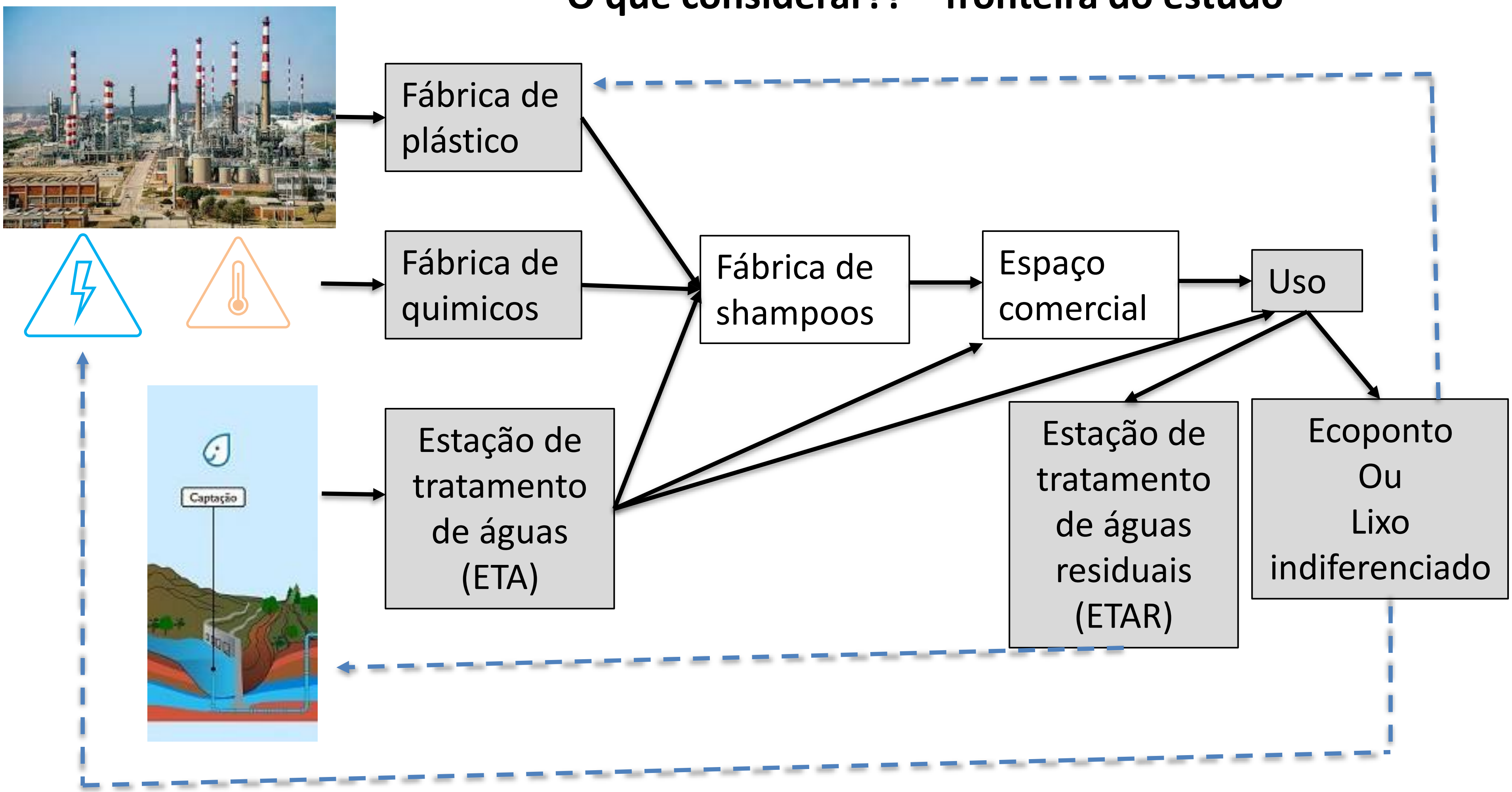
Case study

O que considerar?? – fronteira do estudo



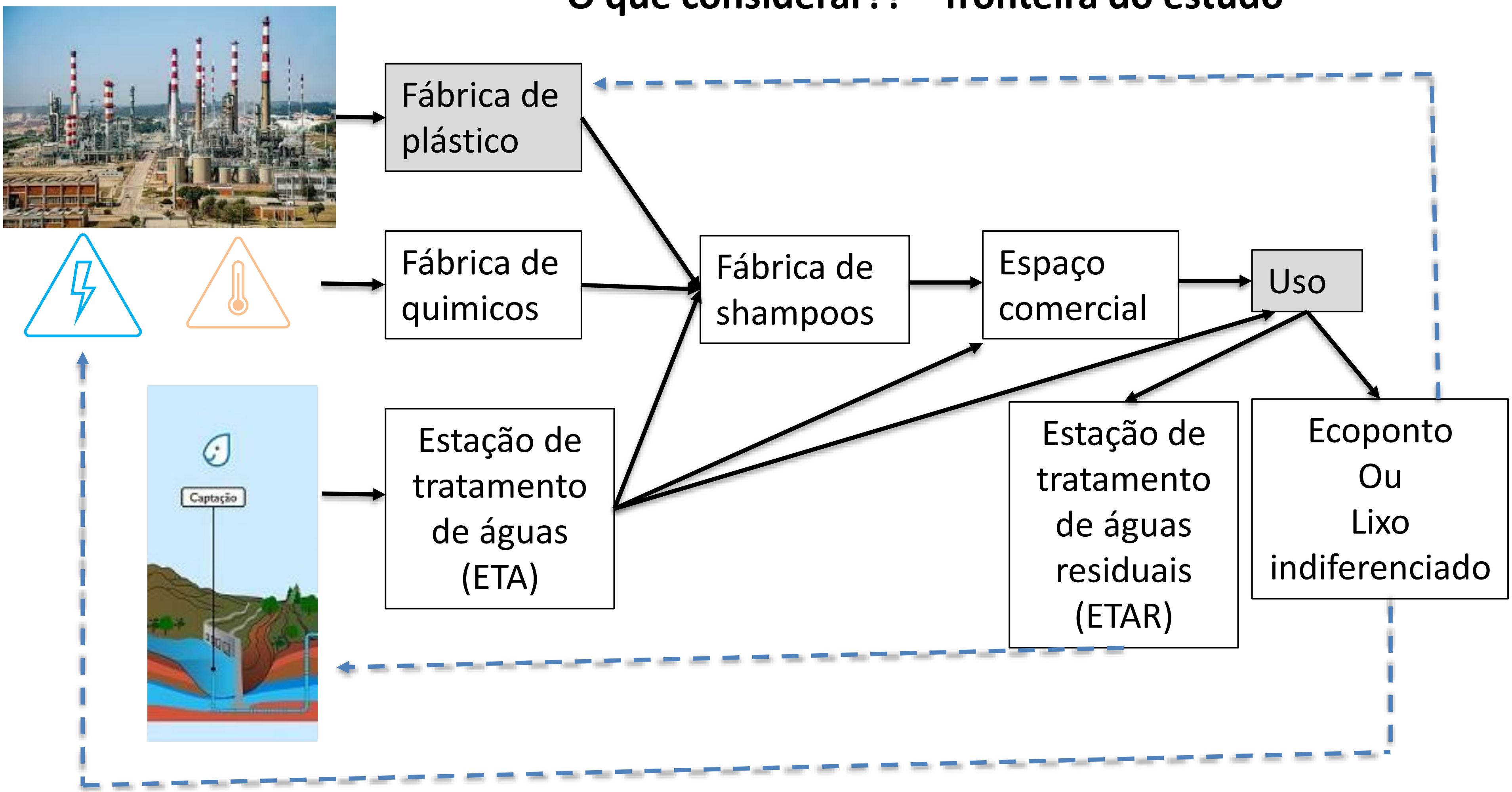
Case study

O que considerar?? – fronteira do estudo



Case study

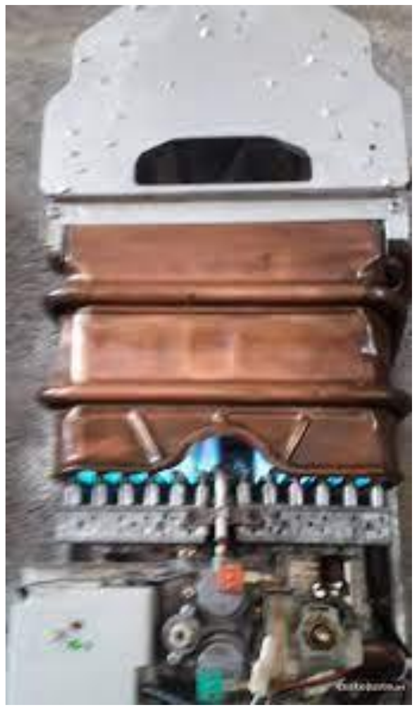
O que considerar?? – fronteira do estudo



Case study

Uso de água: **por defeito 15 l agua/lavagem**

Uso

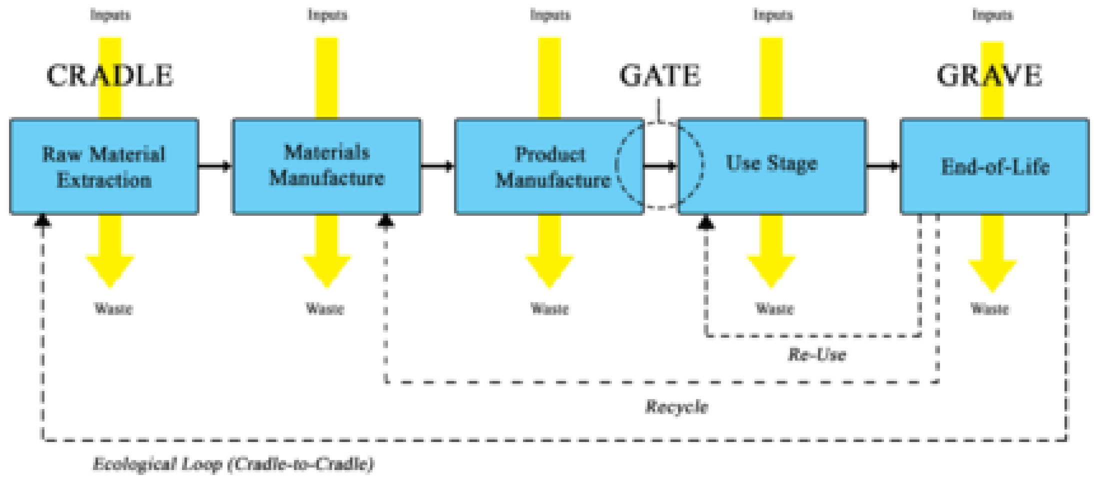


Efic esquentador 90%
Determinação aquecimento água de 20°C para 45 °C: $mcp\Delta T$, cp 4.18 KJ/(kg.K)
Fator combustão gás natural:0.203 gCO2eq/kWh (ver DEFRA, separador FUELS)

Queima de gás natural

Case study

Uso de gás natural:



UK Government GHG Conversion Factors for Company Reporting

WTT- fuels

Index

Gaseous fuels	LPG	tonnes	347.0093
		litres	0.18383
		kWh (Net CV)	0.02719
		kWh (Gross CV)	0.02532
	Natural gas	tonnes	434.42892
		cubic metres	0.34593
		kWh (Net CV)	0.03474
		kWh (Gross CV)	0.03135
		tonnes	434.42892

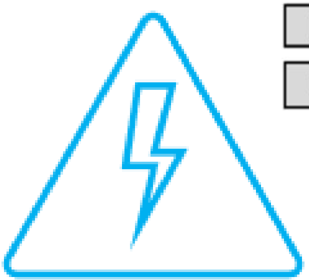
Case study

Uso de eletricidade por lavagem: 10 minutos

Uso

TIPOS DE LÂMPADAS

	COMUM	HALÓGENA	CFL	LED
CONSUMO	40 W	28 W	8 W	4 W
	60 W	42 W	12 W	6 W
	75 W	53 W	15 W	8 W
	100 W	70 W	20 W	10 W
DURABILIDADE	1 ano	1-3 anos	6-10 anos	15-25 anos
ECONOMIA	x	até 30%	até 80%	até 95%



Case study

Quimicos

Function	Ingredient	CAS	DID-list N°	Concentration (wt%)
Anionic surfactant	Sodium laureth sulfate	68891-38-3	8	13.00
Amphoteric surfactant	Cocamidopropyl betaine	61789-40-0	61	8.00
Non-ionic surfactants	Cocamide MEA	68140-00-1	50	1.25
Viscosity controlling agent	Propylene glycol	57-55-6	174	1.00
Preservative	Sodium benzoate	532-32-1	95	0.30
pH-adjustor	Chlorhydric acid	7647-01-0		0.80
Fragrance	alpha-hexyl cinnamaldehyde beta-pinene Dihydromyrcenol Hexyl salicylate Patchouli oil	101-86-0 127-91-3 2436-90-0 115-95-7 84238-39-1	142	0.50
Additional ingredients for additional functions (e.g. hair conditioning agent, hypo-irritancy agent)	Dimethicone	63148-62-9	110	1.00
Additional ingredients for additional functions (e.g. hair conditioning agent, hypo-irritancy agent)	Polyquaternium-10	68610-92-4		0.40
Additional ingredient for aspect (pearlescent / opacifying agent)	Glycol distearate	627-83-8	185	0.50
Solvent	Water			73.25

Case study

Quimicos

Function	Ingredients for base case	Ingredients for worst case	Percentage (%)	Amount (g) in 100 g of product
Saponified oils (92%)	Tallow	Tallow		57
	Coconut oil fatty acids	Coconut oil fatty acids	92%	14
	Stearic acid	Stearic acid		14
Emulsifying / humectant	Glycerine	Propylene glycol	6%	5.52
Perfuming	Perfume	Benzyl alcohol	1%	1.38
Colorant	Colorants	Colorants	0,1%	0.092
Chelating agent	EDTA	EDTA	0,2%	0.184
Bleaching agent	Titanium dioxide	Titanium dioxide	0,1%	0.092
Water	Water	Water	8%	8

ELV – End-of-Life Vehicle

INVENTORY

DATA INTENSIVE

DATA try to use opendata – available to everyone

Try to collect at least 3 values for the same input!!

ISO 14040 prohibits use of a single score for comparison with competitors products

It emphasizes **openness** and **reproducibility** of LCA results

ELV – End-of-Life Vehicle

INVENTORY

- ❑ CHECK MASS BALANCE (INPUT/OUTPUT)
- ❑ CHECK ENERGY BALANCE (INPUT/OUTPUT)
- ❑ CHECK AIR EMISSIONS (CO_2EQ) (INPUT/OUTPUT)

ELV – End-of-Life Vehicle

Collected ELV

- CO_2 and CH_4 both contribute to climate change
- Global Warming Potential (GWP): measure for climate change in terms of radiative forcing of a mass-unit of greenhouse gas
- Example calculation:
  - 5 kg CO_2
  - 3 kg CH_4
  - 1 x 5 + 21 x 3 = 65
  - 68 kg CO_2-eq

impact category

characterisation factor

GWP = 1

GWP = 21

category indicator

category indicator result

ELV – End-of-Life Vehicle

Collected ELV

ICEV – Internal combustion engine vehicle

985 kg

Engine 150 kg

Mass flows in depolluting and dismantling

Battery	15 kg	1.5%
Oil	5.5 kg	0.6%
Brake fluid	0.4 kg	0.04%
Coolant	3.6 kg	0.4%
Oil filter	0.5 kg	0.05%
Catalyst	3.5 kg	0.4%
Tire (5x)	40.7 kg	4%
Glass	26 kg	2.6%
PLASTIC	8.8 kg	0.9%
Metals	738 kg	75%
engine	150 kg	15%
Other	By difference	

ELV – End-of-Life Vehicle

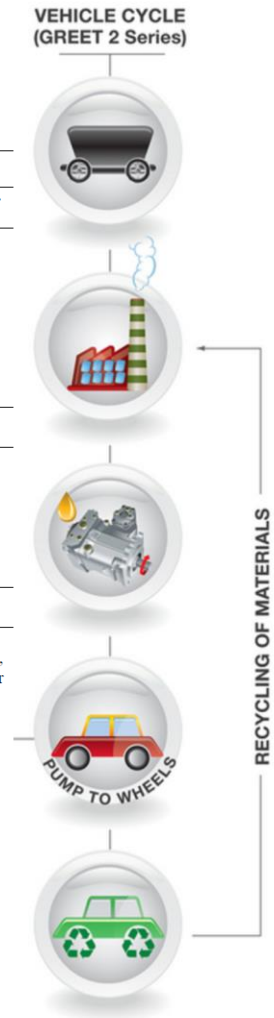
Collected ELV

ICEV – Internal combustion engine vehicle

TABLE 2 Material composition for two populations of vehicle models: late-90s vs. current

Vehicle	Overall Material Percentages in Various Vehicles										
	Vehicle type	Ferrous	Alloys[a]	Other Metals[b]	Plastics[c]	Elastomers[d]	Fluids	Fabrics[e]	Glass	Other	Vehicle Mass - kg
1993 Ford Mondeo	Sedan	70.3	3.4	7.9	6.9	5.9	1.2	f	3.1	1.4	1,214
1993 Ford Escort	Sedan	69.6	6.0	7.3	5.9	5.0	1.3	f	3.3	1.6	1,102
1995 Japan Average[g]	Sedan	72.2	6.2	1.8	10.1	3.1			2.8	3.8	1,270
1998 Ranger Truck	Truck	77.9	4.5	2.0	6.8	5.2	1.7	f	1.2	0.6	1,354
2000 Ford Taurus	Sedan	69.9	7.3	2.5	9.5	5.8	1.3	f	2.2	1.5	1,439
2000 Ford Focus	Sedan	68.5	8.4	2.5	10.0	4.4	1.3	f	2.1	2.8	1,181
2002 Ford Explorer	Truck	66.2	11.6	1.8	9.9	4.8	1.2	f	2.5	1.9	1,969
Generic D-Class Sedan	Sedan	64.3	6.3	2.7	9.3	6.9	4.8	0.7	2.7	2.2	1,532
Average		69.9	6.7	3.7	8.6	5.1					
Standard Deviation		4.1	2.5	2.7	1.7	1.1					
2013 Class E	Sedan	56.3	14.7	2.5	16.9	1.6	4.0	1.2	1.7	0.6	1,910
2014 Class D	Sedan	48.8	18.7	3.9	17.7	1.2	4.8	1.0	1.8	1.7	1,750
2012 Class D	Sedan	56.3	8.7	3.0	20.6	2.8	4.3	0.6	2.6	0.9	1,580
2011	Mini-van	62.7	8.8	3.2	13.1	4.1	3.7	0.7	2.0	0.9	1,960
2013	SUV	53.2	14.8	3.4	17.9	1.8	4.4	1.0	2.3	0.8	2,220
2014 Class D	Sedan	51.7	19.8	3.5	15.5	1.2	4.7	0.4	1.8	0.8	1,790
Average		54.8	14.3	3.3	17.0	2.1					
Standard Deviation		4.8	4.7	0.5	2.5	1.1					

[a] Alloys of aluminum; [b] Included where listed representing copper (in wiring), brass, lead, etc.; [c] Includes polyethylene, polypropylene, nylon, thermoplastics, thermosets, ABS, PVC, others; [d] Includes natural rubber, SBR, urethane elastomers, EPDM, [e] Includes carpeting; [f] In earlier vehicle tear down data, these materials were identified only by their polymer class; [g] Average passenger car in Japan-see Kobayashi, 1997.



Argonne NATIONAL LABORATORY

GREET® Model
The Greenhouse gases, Regulated Emissions, and Energy use in Technologies Model

ELV – End-of-Life Vehicle

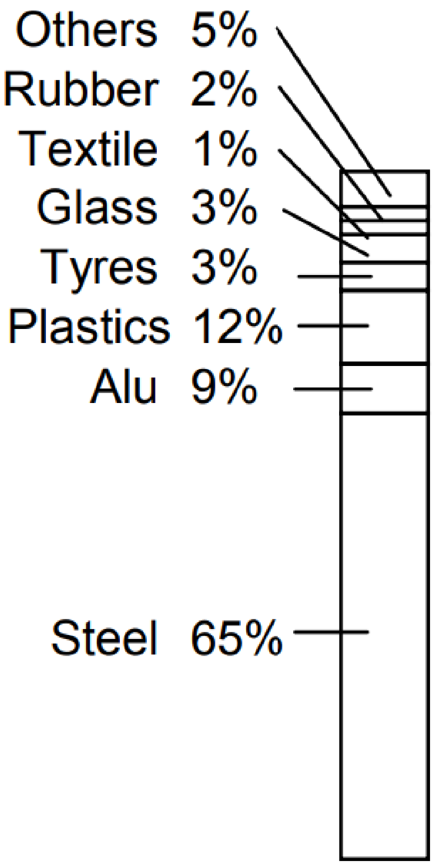
Collected ELV

https://doi.org/10.1080/00207233.2019.1618670

1420 kg

Type	Name	Unit	Weight	Proportion
Hazardous waste parts	Scrap storage battery	kg	11.2	0.8%
	Scrap air conditioner refrigerant	kg	0.3	0.0%
	Scrap three-way catalyst	kg	1.3	0.1%
Remanufactured parts	Scrap engine	kg	120.0	8.5%
Recycled parts	Scrap steel	kg	820.3	57.8%
	Scrap aluminium	kg	79.5	5.6%
	Scrap copper	kg	12.9	0.9%
	Scrap zinc	kg	3.98	0.3%
	Scrap plastic	kg	159.3	11.2%
	Scrap glass	kg	66.9	4.7%
	Scrap tire	kg	80.0	5.6%
	Scrap circuit board	kg	0.7	0.1%
	Scrap oil	kg	0.4	0.031%
Non-recyclable parts	ASR	kg	61.7	4.3%
Total amount		kg	1420	100%

ELV – End-of-Life Vehicle



Average car compo
(weight %)

https://ec.europa.eu/environment/pdf/waste/study/final_report.pdf

ELV – End-of-Life Vehicle

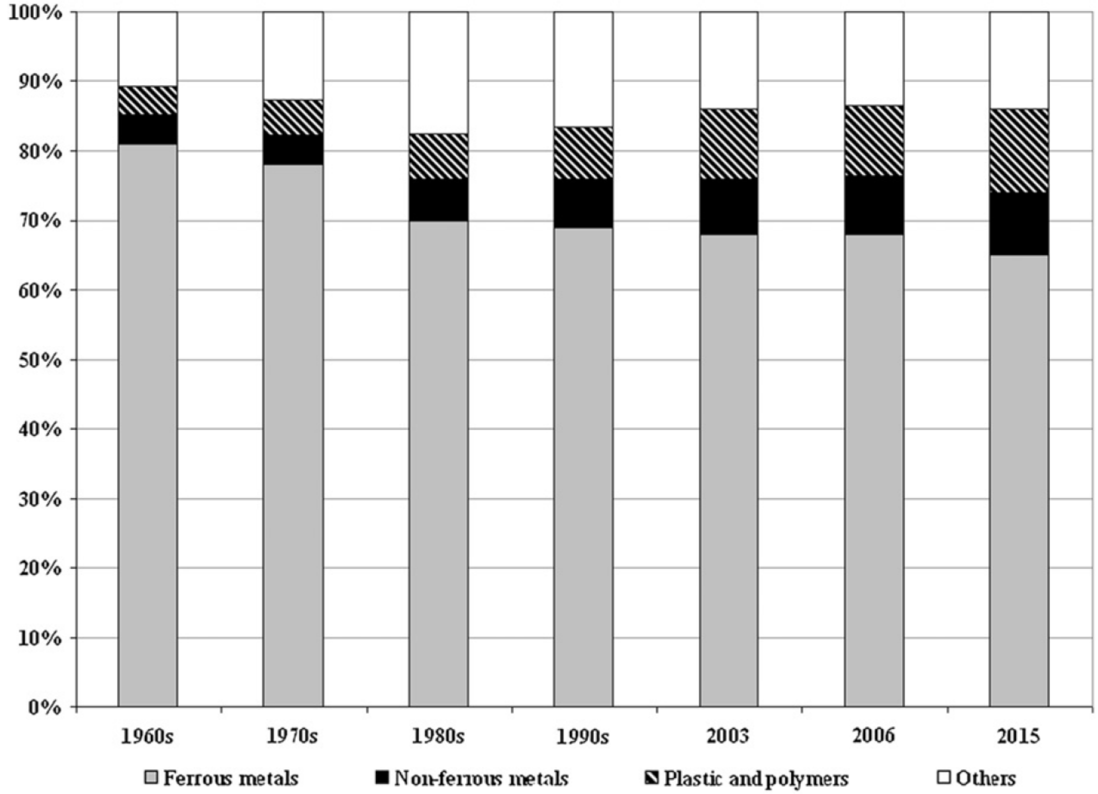


Fig. 1. Variation in vehicles composition over the last decades and previsions for the year 2015. (Source: elaboration from COM Report, 2007; GHK/BIOIS, 2006; Jody and Daniels, 2006).

doi:10.1016/j.jclepro.2011.10.028

ELV – End-of-Life Vehicle

Mass flows in depolluting and dismantling

Collected ELV

Main plastic polypropylene (PP)

Because polypropylene (PP) is low in cost but has out- standing mechanical properties and moldability, it accounts for more than half of all the plastic materials used in automobiles

$(C_3H_6)n$

ELV – End-of-Life Vehicle

Mass flows in depolluting and dismantling

Collected ELV

https://doi.org/10.1016/j.spc.2021.09.025

Table 1
Main features and annual flows amount for Current and Innovative scenarios of ELVP management in Europe (see also Fi

ELV plastics treatment, %	Current
ELVP from dismantling directly to reuse/re-manufacturing/Extruclean/ thermal treatments/disposal	**8%**
ELVP to shredding	**92%**
of which	
ELVP from shredding to PST	31%
ELVP from shredding to direct energy recovery	29%
ELVP from shredding to landfilling	40%
Data sources	(Eurostat Database, 2020)

ELVP – End-of-Life Plastic

PST -post-shredding treatment

ELV – End-of-Life Vehicle

ASR – Automotive Shredder Residue

is the leftover material that remains after the shredding of vehicles and recovering of metals.

ELV – End-of-Life Vehicle

Collected ELV

Table 1. Average composition of each ASR material mix considered for this study. Values are in kilograms.

https://doi.org/10.1016/j.jclepro.2011.10.028

Material type	ASR material mix		
	ASR1	ASR2	ASR3
Aluminum	70	100	100
Copper	4.4	4.4	4.4
Steel	5.9	5.9	5.9
Iron scrap	26.5	0	0
Lead	0.4	0.4	0.4
Brass	2.8	2.8	2.8
Total Metals and alloys	**110**	**113.5**	**113.5**
Acrylonitrile Butadiene Styrene (ABS)	33.6	38.5	38.5
Polypropylene (PP)	86.4	99	187
Polyethylene (PE)	19.2	22	22
Polyurethane Foam (PUR)	168	192.5	192.5
Polyvinil Chloride (PVC)	67.2	77	77
Polyamides (PA)	28.8	33	33
Other plastics	76.8	88	0
Total Polymers	**480**	**550**	**550**
Varnish	56	26.5	26.5
Glass	42	20	20
Sand	42	20	20
Total Fines	**140**	**66.5**	**66.5**

16% (Total Metals and alloys)

75% (Total Polymers)

8% (Total Fines)

ASR – Automotive Shredder Residue

Further processing for Energy recovery

ELV – End-of-Life Vehicle

insurance case .... is a vehicle that has become waste prematurely, e.g. due to an accident or infestation.

LCA .... 'life cycle assessment' is a method to evaluate the environmental impact from the complete life cycle of a product, process or activity.

recovery .... means to reprocess waste materials in a production process for the original
purpose or for other purposes, including energy recovery.

recycling .... means to reprocess waste materials in a production process for the original purpose or for other purposes, excluding energy recovery.

reuse .... means any operation by which components are used for the same purpose for which they were created.

Ciências ULisboa

CHALENDGE #2

Life Cycle Inventory of ELV End-of-Life Vehicle.

1. Identity materials mass flows per ton of ELV (FU-Functional unit = 1 Ton ELV). Tip: You have to decompose one ELV into its constituting materials, such as metals, plastics, fluids (lubricating oil, refrigerant, windshield cleaning fluid….)
2. Identify material, flows and final destination (incineration, landfill, valorization) in excel and draw a scheme (e.g. https://app.diagrams.net/), input/output
3. Calculate the massic % REUSE and %RECYCLING total and by constitutent materials of cars

Deliver until 21 October

ELV – End-of-Life Vehicle

INVENTORY

Collected ELV

- ❑ CHECK MASS BALANCE (INPUT/OUTPUT)
- ❑ CHECK ENERGY BALANCE (INPUT/OUTPUT)
- ❑ CHECK AIR EMISSIONS (CO_2EQ) (INPUT/OUTPUT)

ELV – End-of-Life Vehicle

Collected ELV

INVENTORY

From: Pedro Pinto <pedro.pinto@valorcar.pt>
Sent: Tuesday, October 11, 2022 3:20 PM
To: Carla Silva <camsilva@fc.ul.pt>
Subject: FCUL - RE: dados para os nossos cálculos VLC:005003830

Boa tarde Carla,

Relativamente ao solicitado, informo que não dispomos de dados que permitam distinguir os consumos energéticos de cada fase de tratamento dos VFV.

Quanto às distâncias entre compactador e triturador, assumo que se refira à distância entre os centros de abate e as unidades de fragmentação. Neste caso, não é possível determinar uma distância única pois existem cerca de 300 centros de abate e pelo menos 6 fragmentadores. Seguem as moradas/localizações de todos:

Centros de abate: https://www.valorcar.pt/pt/mapa
Fragmentadores:

- AMBIGROUP RECICLAGEM - Rua da Indústria nº 473 Zona Industrial do Casal do Marco, Arrentela 2840-185 SEIXAL
- BATISTAS - Qta S.Julião e Nabais - Casal Pinheiro 2580-507 CARREGADO
- CFO - Travessa da Seada, 471 Apartado 73 - EC carvalhos 4416-901 PEDROSO
- ECOMETAIS - Av. da Siderurgia Nacional, nº1 Edifício SN Apartado 132 2840-075 ALDEIRA DE PAIO PIRES
- MJD - Rua do Sanguinhal 4745-201 GUIDÕES-TROFA
- RSA - Av. António Farinha Pereira, 1770 Zona Industrial 2200-024 ABRANTES

Quanto às distâncias entre fragmentadores e aterro, também não é possível determinar uma distância única dado existirem vários fragmentadores e vários destinos possíveis. Seguem as localidades de destino dos materiais enviados para aterro e também dos materiais enviados para valorização (valorização energética em fornos de cimenteiras, por exemplo):

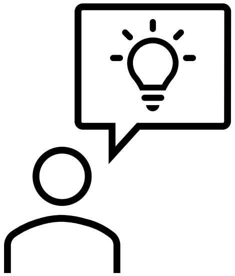
Destinos aterro:
VN Famalicão, Braga
Setúbal, Setúbal
Leiria, Leiria
Alenquer, Lisboa
Castelo Branco, Castelo Branco
Abrantes, Santarém

Destinos Valorização:
Legutio, Álava, Espanha
Pavierna, Asturias, Espanha
Seixal, Setúbal
Gondomar, Porto
Souselas, Coimbra
Abrantes, Santarém
Outão, Setúbal
Setúbal, Setúbal
Palmela, Setúbal
Leiria, Leiria

Com os melhores cumprimentos,

Pedro Pinto
Departamento Técnico
valorcar
valorizamos o ambiente
Av. da Torre de Belém, 29
1400-342 LISBOA
(+351) 21 301 17 66
valorcar@valorcar.pt
valorcar.pt

NÃO DISPOMOS DE DADOS........



Energy consumption DATA

CHALMERS

Energy consumptions and CO_2 emissions resulting from different handling strategies of glass from end-of-life vehicles.

Master of Science Thesis

HENRIC LASSESSON

Department of Chemical and Biological Engineering
Division of Industrial Materials Recycling

CHALMERS UNIVERSITY OF TECHNOLOGY
Göteborg, Sweden, 2008

ELV – End-of-Life Vehicle

4.7L/h * 2.5min/60h = 0.2 litres of diesel per ELV

Or 6kWh/h* 2.5 min/60h = 0.25 kWh per ELV

forklift

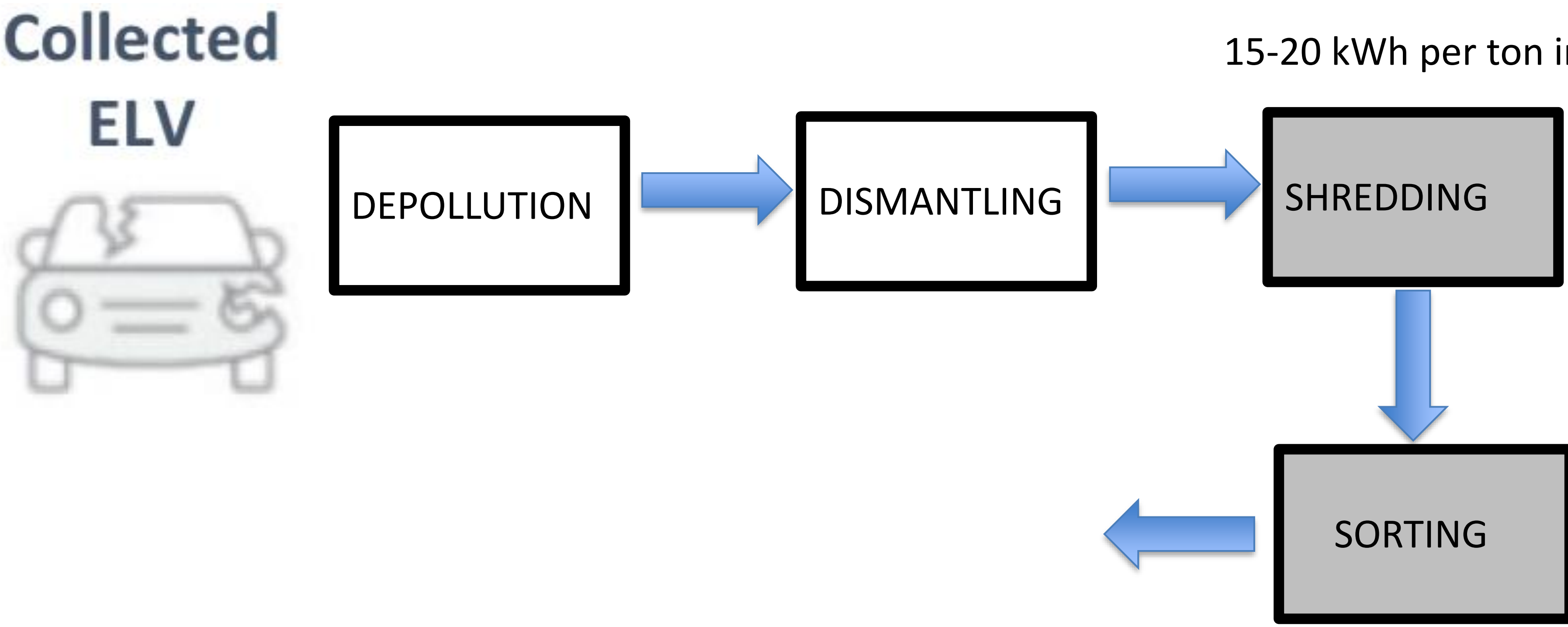
Collected ELV

DEPOLLUTION → DISMANTLING → SHREDDING → SORTING

ELV – End-of-Life Vehicle

Approximately 90 % of the energy consumption originates from the hammer mill and the other 10 % from conveyor belts, magnets, sieves and other parts of the
separation process

15-20 kWh per ton input



ELV – End-of-Life Vehicle

ASR glass:

1 kg of glass will most likely substitute 1 kg of sand in **LANDFILL** construction material

0.10 MJ of electric energy per kg of glass will be saved in this step

0.000684 MJ of electricity and 0.035 MJ of diesel per kg of waste

LANDFILL management

Energy consumption DATA

University of Windsor

Scholarship at UWindsor

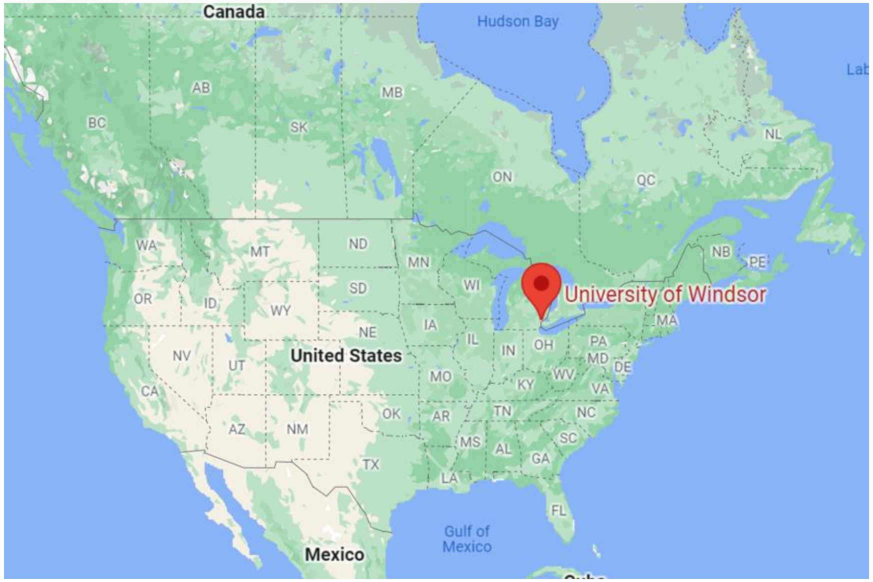
Electronic Theses and Dissertations | Theses, Dissertations, and Major Papers

2009

Gate-to-gate life cycle inventory assessment of North American end-of-life vehicle management processes

Susan S. Sawyer-Beaulieu

University of Windsor



Recommended Citation

Sawyer-Beaulieu, Susan S., "Gate-to-gate life cycle inventory assessment of North American end-of-life vehicle management processes" (2009). *Electronic Theses and Dissertations*. 8084.
https://scholar.uwindsor.ca/etd/8084

Energy consumption DATA

DISMANTLING

23.1 kWh/TonELV

Table 14 Summary of LCI system inputs and outputs for the dismantling process

System Inputs and Outputs			Criteria	Per tonne of ELVs processed (Core Parts Excluded)	% Weight of ELVs processed (Core Parts Excluded)	Per tonne of ELVs & CORES processed	% Weight of ELVs & CORES processed
Inputs	ELVs	Total	kg	1000.0	100.0%	1000.0	100.0%
		LSELVs	kg	867.6	86.8%	866.8	86.7%
		HSELVs	kg	132.4	13.2%	132.2	13.2%
	CORE Parts		kg	----	----	0.97	0.1%
	Electrical Energy		kW-hr	23.1	----	----	----
Outputs	*Parts for Reuse*	Total	kg	57.0	5.7%	57.2	5.7%
		From LSELVs	kg	8.1	0.8%	8.1	0.8%
		From HSELVs	kg	48.9	4.9%	48.9	4.9%
		CORE Parts	kg	----	----	0.2	0.02%
	Parts for Remanufacturing	From HSELVs & CORE Parts	kg	1.2	0.12%	1.2	0.1%
	Parts for Recycling	Total	kg	39.1	3.9%	39.1	3.9%
		From LSELVs	kg	34.3	3.4%	34.2	3.4%
		From HSELVs	kg	4.9	0.5%	4.9	0.5%
	Recovered Fluids	Total	kg	19.0	1.9%	19.0	1.9%
		Directed for Reuse	kg	13.8	1.4%	13.8	1.4%
		Directed for Recycling	kg	5.3	0.5%	5.3	0.5%
	Parts Deleted or Purged from Inventory		kg	3.9	0.4%	3.9	0.4%
	ELV Hulks and Parts Shipped for Shredding		kg	883.7	88.37%	883.6	88.4%

Energy consumption DATA

SHREDDING

28.8 kWh/Tonfeed

Table 31 Summary of LCI systems inputs and outputs for the shredding process

System Inputs and Outputs				Criteria (per tonne of shredder feed material)	Per tonne of Shredder Infeed	% Weight of Shredder Infeed
Inputs	ELV Hulks			kg	576.0	57.6%
	Other Oversized Metals-rich Scrap			kg	424.0	42.4%
	Electrical Energy			kW-hr	28.8	---
	Process Water			liters	5.7	---
Outputs	Shredded Ferrous Product	Total output		kg	775.3	77.5%
		Recovered Metals	Ferrous Metals	kg	713.3	71.3%
		Contaminants and/or Losses	Non-Ferrous Metals & Non-metals	kg	62.0	6.2%
	Non-Ferrous Residue	Total output		kg	32.6	3.3%
		Recovered Metals	Non-Ferrous Metals	kg	26.1	2.6%
		Contaminants and/or Losses	Ferrous Metals	kg	0.7	0.1%
			Non-metals	kg	5.9	0.6%
	Shredder Residue			kg	192.1	19.2%
	Process Waste Water			liters	0	---

ELV – End-of-Life Vehicle

ASR – Automotive Shredder Residue

Further processing for Energy recovery

ELV – End-of-Life Vehicle

ASR – Automotive Shredder Residue

is the leftover material that remains after the shredding of vehicles and recovering of metals.

ELV – End-of-Life Vehicle

Collected ELV

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Iron scrap	26.5	0	0
Lead	0.4	0.4	0.4
Brass	2.8	2.8	2.8
Total Metals and alloys	**110**	**113.5**	**113.5**
Acrylonitrile Butadiene Styrene (ABS)	33.6	38.5	38.5
Polypropylene (PP)	86.4	99	187
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Varnish	56	26.5	26.5
Glass	42	20	20
Sand	42	20	20
Total Fines	**140**	**66.5**	**66.5**

16%

75%

8%

![Ciências ULisboa logo]

ELV – End-of-Life Vehicle

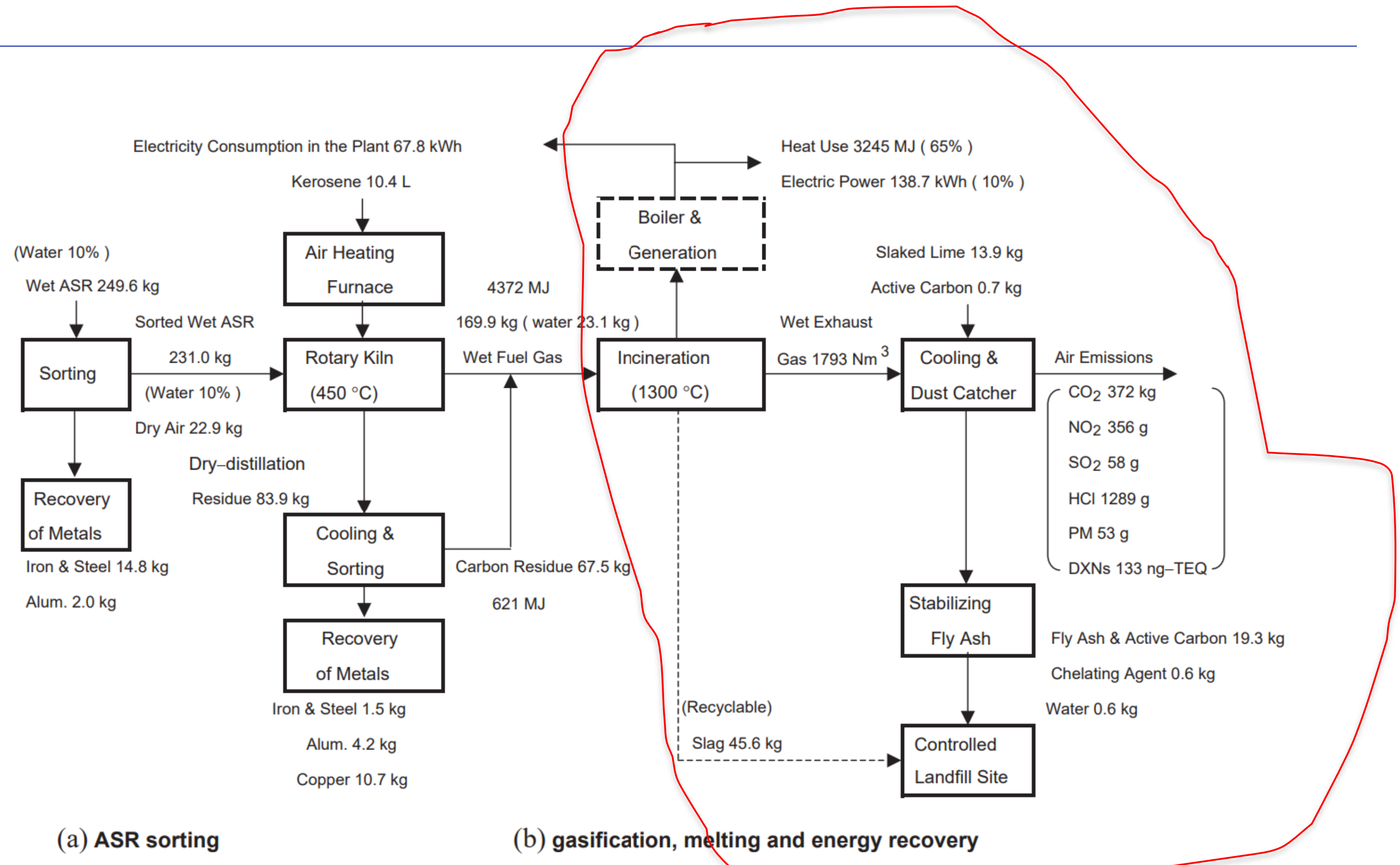
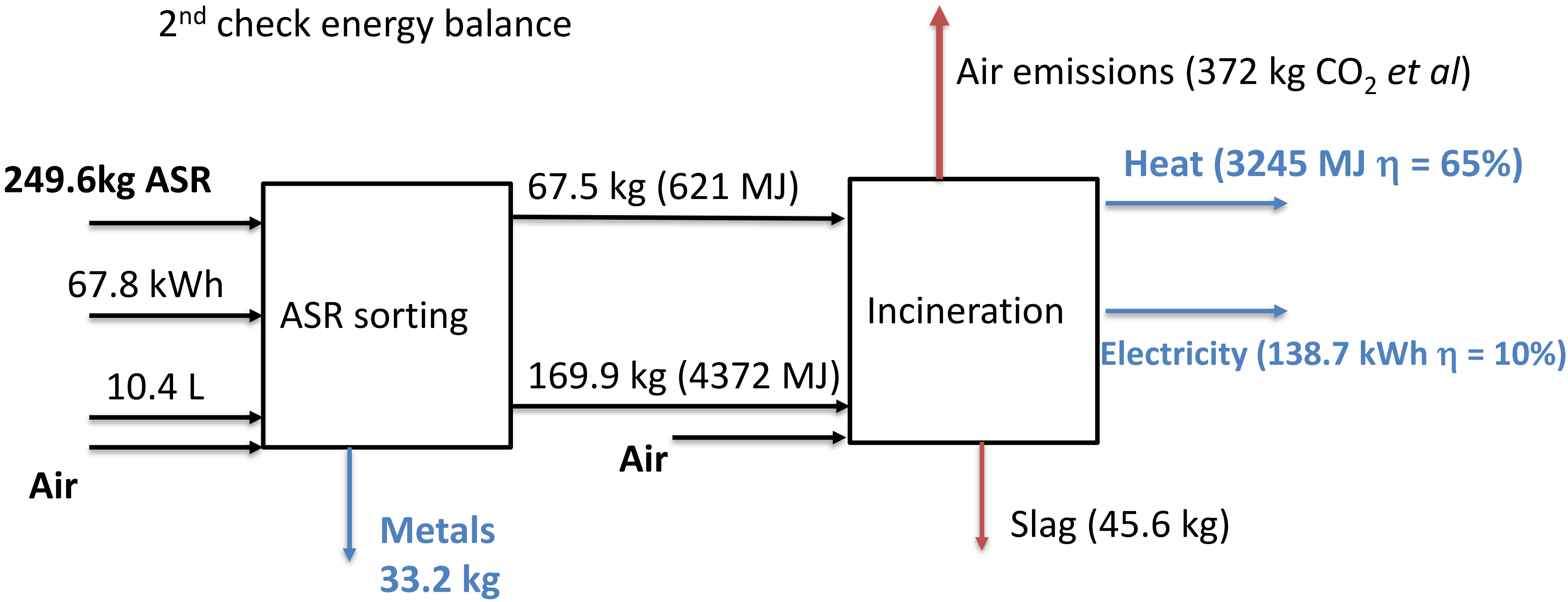


Fig. 2. System flows of the rotary kiln type gasification and melting plant for ASR.

Automobile life cycle assessment issues at end-of-life and recycling JSAE Review 24 (2003) 381–386

ELV – End-of-Life Vehicle

1st check mass balance correctness (INPUT=OUTPUT)
2nd check energy balance



Kerosene
LHV = Lower Heating Value = 37.8 MJ/L

Automobile life cycle assessment issues at end-of-life and recycling JSAE Review 24 (2003) 381–386

CHALENDGE #3

Life Cycle Inventory of ELV End-of-Life Vehicle.

1. Identity energy flows per ton of ELV (FU-Functional unit = 1 Ton ELV).
2. Identify base scenario, without ASR further processing and with ASR further processing.
3. Identify electricity generation mix for the last 5 years, and what would be in 2050.

Deliver until 11 November

CHALENDGE #3

TIP use the same excel then previous challenge

Useful links

https://www.dgeg.gov.pt/pt/estatistica/energia/eletricidade/producao-anual-e-potencia-instalada/

https://apambiente.pt/sites/default/files/_Clima/Inventarios/2022FEGEEEletricidade.pdf

ELV – End-of-Life Vehicle

EMISSIONS IN THE ATMOSPHERE

It is necessary to keep in mind that we
are not reporting the environmental impacts water and soil pollution

Thanks

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Faculdade
de Ciências
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