



# Life Cycle Assessment of Manufacturing Tires

Ing. Cecilia Tejada

# JUSTIFICATION

In Peru, about 65% of the vehicular fleet mobilizes; in Lima: 42% automobile followed by 21% of truck

A research conducted by Universidad Agraria (Lima, Peru) in April 2006 has shown the final disposal of scrap tires:

80% took up space in public places.

8% are used as fuel

7% are recycled into products

5% are used in recreative uses

Currently, Peru has no applicable legislation that regulates the tire derived fuel



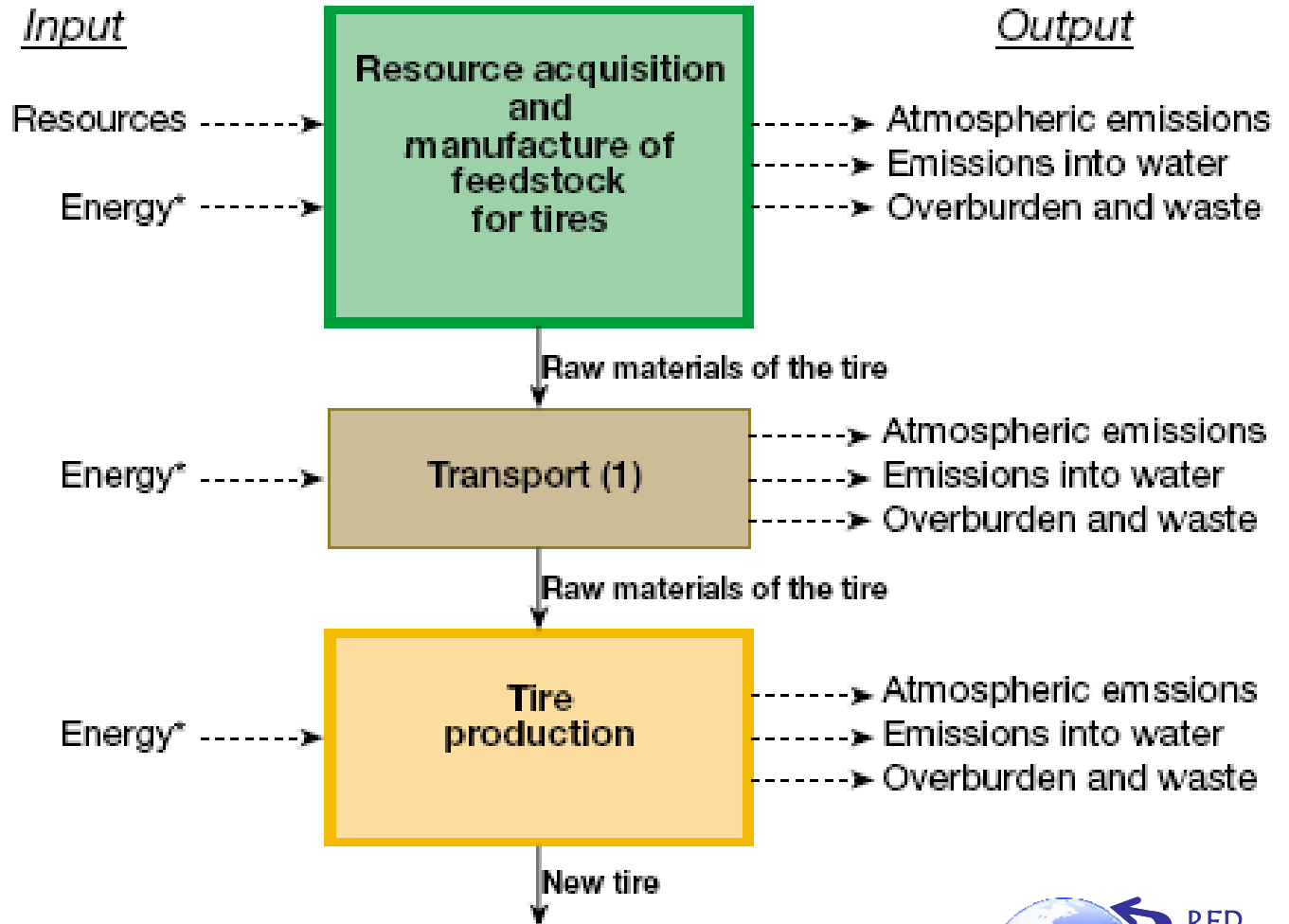
# GOAL

I. Development a Life Cycle Inventory to manufacturing tires.

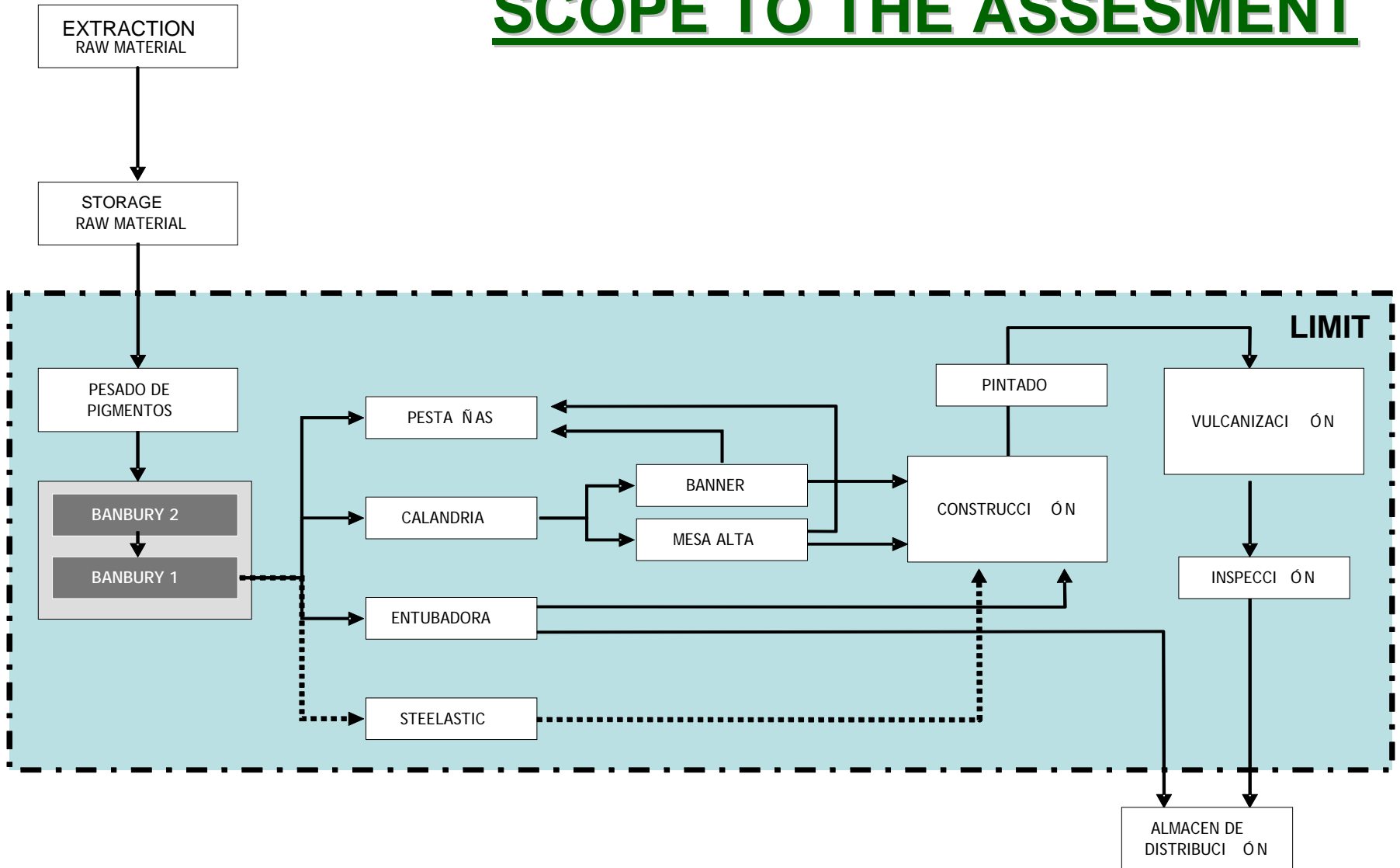
II. Environmental input/output balance to optimice the process.

III. Reducing the quantities of hazard materials, waste, oil waste, water and fuel.

# SCOPE TO THE ASSESSMENT



# SCOPE TO THE ASSESSMENT



<b>Producción de llantas</b>	<b>Kg</b>	<b>3,012,714</b>	<b>3,140,701</b>	<b>3,183,067</b>	<b>2,897,529</b>	<b>2,635,128</b>	<b>3,111,608</b>	<b>3,599,904</b>	<b>3,028,605</b>	<b>2,597,161</b>	<b>2,226,916</b>	<b>3,128,028</b>	<b>2,501,006</b>
------------------------------	-----------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------

	UNIDADES	ENERO	FEBRERO	MARZO	ABRIL	MAYO	JUNIO	JULIO	AGOSTO	SETIEMBRE	OCTUBRE	NOVIEMBRE	DICIEMBRE
<b>RECURSOS UTILIZADOS</b>													
Lubricante interno (2004)	Kg	1920	2112	1728	1344	1536	1536	1728	1536	1728	1344	1344	1724
Lubricante externo (2004)	Kg	1400	1000	1600	800	1400	800	1200	800	800	700	800	800
Cemento (2004)	Kg	8031	7790	9536	7632	8501	8322	8289	6924	8083	8133	9106	9485
Pintura identificación de rodados (2004)	Kg	37.84	36.927	37.805	33.12667	37.26778	35.89	39.335	38.928	36.75	8.47	40.19	38.50666667
Energía	BTU	5764.881	5876.21284	5694.352	5803.945	5683.329	5474.749	5638.58	5438.31	5830.238369	5608.7728	5769.011363	5645.931653
Electricidad	KWH	280013.3	274015.3	289957.9	273939.7	277527.7	272950.3	271548.5	279056.1	278542.1	223130.9	274099.9	270117.1
Bunker 6	gl	2043	850	2590	1476	1300	600	8290	3450	1300	1900	300	1000
Gas Natural	m3	1400	3700	5460	6300	4277	4814.9	3367	70	0	2443.38	1333.55	0
Nitrógeno	Kg	71110	64099	76115	66946	77330	74460	72900	74750	70740	59030	65030	64720
Agua	gl	464.7575	410.975615	478.0986	461.7749	451.681	452.2959	423.0132	413.4867	457.7471174	348.86232	420.2586241	426.1965229

<b>MATERIA PRIMA</b>													
<b>Pigmentos</b>	<b>Kg</b>	<b>225118</b>	<b>2346834.17</b>	<b>2378491</b>	<b>2165128</b>	<b>1969054</b>	<b>2325095</b>	<b>2689966</b>	<b>2263072</b>	<b>1940683.367</b>	<b>1664024.2</b>	<b>2337364.495</b>	<b>1868833.216</b>
ADAMAX-O	Kg	17813.58	18570.3369	18820.84	17132.51	15580.98	18398.32	21285.51	17907.54	15356.49356	13167.309	18495.40396	14787.94828
BEROLIC	Kg	145885	152082.479	154134	140307.3	127601.1	150673.7	174318.5	146654.4	125762.5868	107834.18	151468.8126	121106.4636
GOODINE	Kg	129896.2	135414.464	137241.1	124929.9	113616.2	134160.1	155213.5	130581.3	111979.1937	96015.71	134868.0552	107833.3747
HAWKAX	Kg	1044.207	1088.56697	1103.251	1004.284	913.3354	1078.483	1247.727	1049.714	900.1760026	771.84909	1084.174505	866.8486796
KERWAX	Kg	309728.1	322886.048	327241.6	297886.3	270909.6	319895.1	370095.3	311361.8	267006.3309	228942.55	321583.1746	257120.9238
LEIBAX	Kg	4262.388	4443.46377	4503.403	4099.424	3728.179	4402.303	5093.144	4284.87	3674.463383	3150.6408	4425.534014	3538.423289
NAILAX	Kg	46278.9	48244.9362	48895.73	44509.52	40478.73	47798.03	55298.85	46523.01	39895.50955	34208.102	48050.26371	38418.45337
OLIVAX	Kg	14232.66	14837.2997	15037.45	13688.51	12448.87	14699.86	17006.67	14307.74	12269.508	10520.397	14777.42988	11815.25255
PHENAX-S	Kg	6998.836	7296.16249	7394.583	6731.25	6121.666	7228.577	8362.937	7035.752	6033.464719	5173.3486	7266.721847	5810.087039
RENARDIC	Kg	864.0464	900.753047	912.9036	831.0113	755.7547	892.4092	1032.452	868.6039	744.8657748	638.67951	897.1184304	717.2885208
ROSNIC	Kg	27767.88	28947.527	29338.01	26706.24	24287.71	28679.38	33179.96	27914.35	23937.77322	20525.262	28830.72127	23051.5222
SPONBAX	Kg	54807.29	57135.6326	57906.35	52711.85	47938.25	56606.37	65489.45	55096.38	47247.55291	40512.056	56905.08538	45498.30115
STERAX-B	Kg	101785.7	106109.84	107541.2	97894.18	89028.85	105126.9	121624.2	102322.6	87746.12325	75237.248	105681.6772	84497.48811
STOVIC	Kg	870174.2	907141.233	919378	836904.9	761114.6	898738.2	1039775	874764.1	750148.4003	643209.06	903480.8394	722375.567
SURFAX	Kg	41866.18	43644.7514	44233.49	40265.51	36619.06	43240.46	50026.07	42087.01	36091.44784	30946.338	43468.6411	34755.22988
TUAX	Kg	7913.797	8249.99339	8361.28	7611.229	6921.954	8173.572	9456.228	7955.54	6822.222515	5849.6629	8216.70395	6569.642561
ULTRAX	Kg	36120.33	37654.8065	38162.75	34739.34	31593.34	37306	43160.33	36310.85	31138.14238	26699.164	37502.8661	29985.31124
ZONFLAX	Kg	138806.6	144703.402	146655.4	133499.6	121409.8	143363	165860.5	139538.7	119660.557	102602.04	144119.5109	115230.35
601	Kg	285961.1	298109.372	302130.7	275027.9	250121.3	295347.9	341696	287469.4	246517.5875	211374.64	296906.4745	237390.7376
844	Kg	8991.144	9373.10806	9499.545	8647.386	7864.276	9286.283	10743.55	9038.569	7750.967288	6646.0081	9335.286763	7464.002306
<b>Caucho sintético</b>	<b>Kg</b>	<b>9001153</b>	<b>9383542.42</b>	<b>9510120</b>	<b>8657012</b>	<b>7873031</b>	<b>9296621</b>	<b>10755513</b>	<b>9048631</b>	<b>7759595.836</b>	<b>6653406.6</b>	<b>9345679.011</b>	<b>7472311.399</b>
BUD 1207	Kg	2083290	2171793.17	2201089	2003640	1822190	2151675	2489332	2094279	1795935.533	1539911.3	2163029.798	1729444.398
LUNARIC	Kg	6830845	7121035.12	7217093	6569682	5974730	7055071	8162204	6866875	5888645.463	5049174.4	7092301.129	5670629.443
STOVIC	Kg	87017.42	90714.1233	91937.8	83690.49	76111.46	89873.02	103977.5	87476.41	75014.84003	64320.906	90348.08394	72237.5567
<b>Caucho Natural (NOLO)</b>	<b>Kg</b>	<b>4040424</b>	<b>4212070.43</b>	<b>4268889</b>	<b>3885947</b>	<b>3534034</b>	<b>4173053</b>	<b>4827919</b>	<b>4061736</b>	<b>3483115.728</b>	<b>2986571.2</b>	<b>4195074.362</b>	<b>3354159.921</b>
<b>Aceites (URBONINE)</b>	<b>Kg</b>	<b>1343062</b>	<b>1400118.85</b>	<b>1419006</b>	<b>1291713</b>	<b>1174735</b>	<b>1387149</b>	<b>1604831</b>	<b>1350147</b>	<b>1157809.699</b>	<b>992755.14</b>	<b>1394469.252</b>	<b>1114943.973</b>
<b>Tela NV (Pestaña)</b>	<b>Kg</b>	<b>6025.428</b>	<b>6281.402</b>	<b>6366.134</b>	<b>5795.058</b>	<b>5270.256</b>	<b>6223.216</b>	<b>7199.808</b>	<b>6057.21</b>	<b>5194.322</b>	<b>4453.832</b>	<b>6256.056</b>	<b>5002.012</b>
<b>Texina (XP-323)</b>	<b>Kg</b>	<b>201485.5</b>	<b>210045.058</b>	<b>212878.4</b>	<b>193782.1</b>	<b>176233.1</b>	<b>208099.4</b>	<b>240755.8</b>	<b>202548.3</b>	<b>173693.9722</b>	<b>148932.58</b>	<b>209197.5078</b>	<b>167263.2797</b>
<b>Alambre 038HT (Pestaña)</b>	<b>Kg</b>	<b>608568.2</b>	<b>634421.602</b>	<b>642979.5</b>	<b>585300.9</b>	<b>532295.9</b>	<b>628544.8</b>	<b>727180.6</b>	<b>611778.2</b>	<b>524626.522</b>	<b>449837.03</b>	<b>631861.656</b>	<b>505203.212</b>
<b>Negro de Humo</b>	<b>Kg</b>	<b>7085667</b>	<b>7386682.84</b>	<b>7486324</b>	<b>6814761</b>	<b>6197615</b>	<b>6718258</b>	<b>8466692</b>	<b>7123042</b>	<b>6108319.314</b>	<b>5237532.1</b>	<b>7356876.931</b>	<b>5882170.283</b>
1099	Kg	341584.8	356096.134	360899.6	328525	298773.7	352797.5	408161.1	343386.6	294468.9711	252490.19	354659.2555	283566.8114
405	Kg	2308210	2406268.49	2438727	2219961	2018920	2383979	2758090	2320385	1989831.782	1706166.2	2396558.984	1916162.003
510	Kg	4435872	4624318.22	4686697	4266276	3879921	4581482	5300441	4459270	3824018.562	3278875.7	4605658.692	3682441.468
<b>Silical (1171)</b>	<b>Kg</b>	<b>126914.2</b>	<b>132305.798</b>	<b>134090.5</b>	<b>122061.9</b>	<b>111007.9</b>	<b>131080.2</b>	<b>151650.3</b>	<b>127583.6</b>	<b>109408.5237</b>	<b>93811.509</b>	<b>131771.9331</b>	<b>105357.879</b>

# METODOLOGY

1. Identify the process: input-output of each other.
2. Follow the same rubber
3. Number of tires produced (all type)
4. Only include the production process, not maintenance.
5. The water consumption, energy and fuel are the environmental aspect.

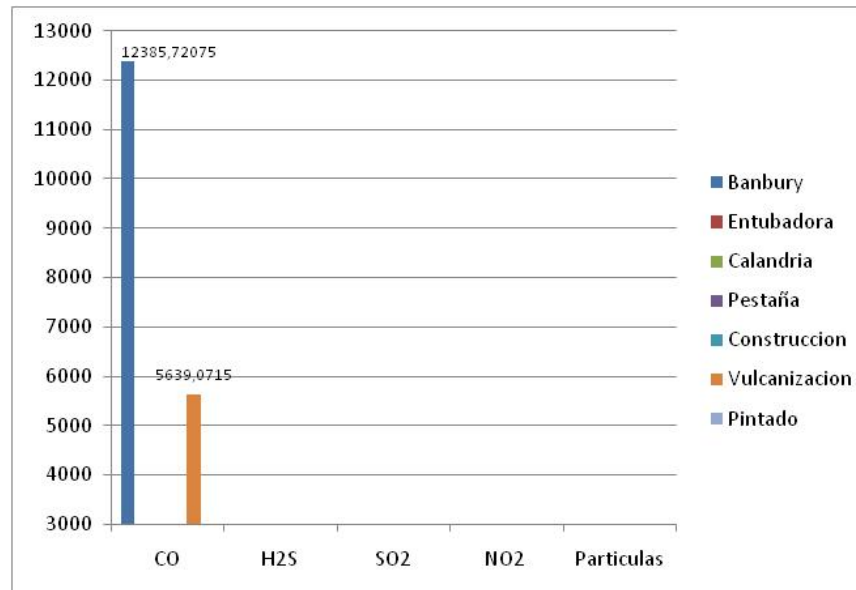
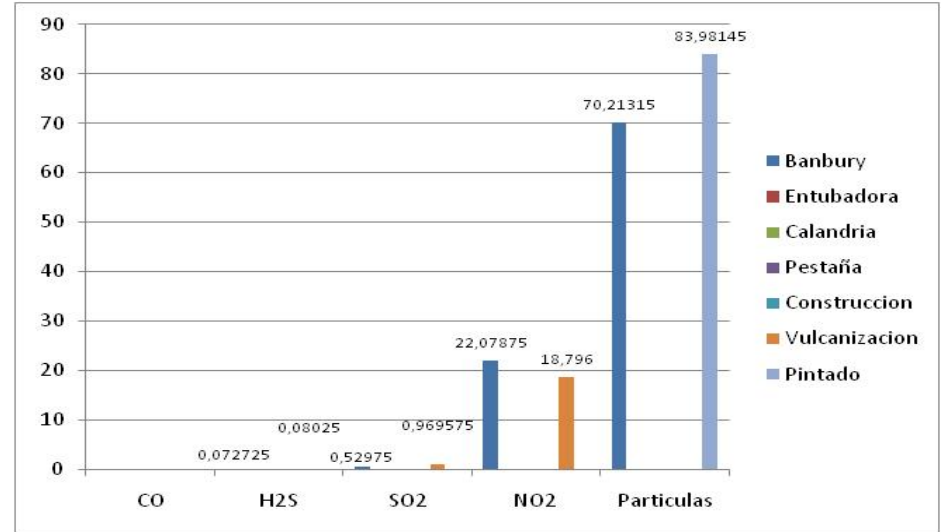
# Input - Out put



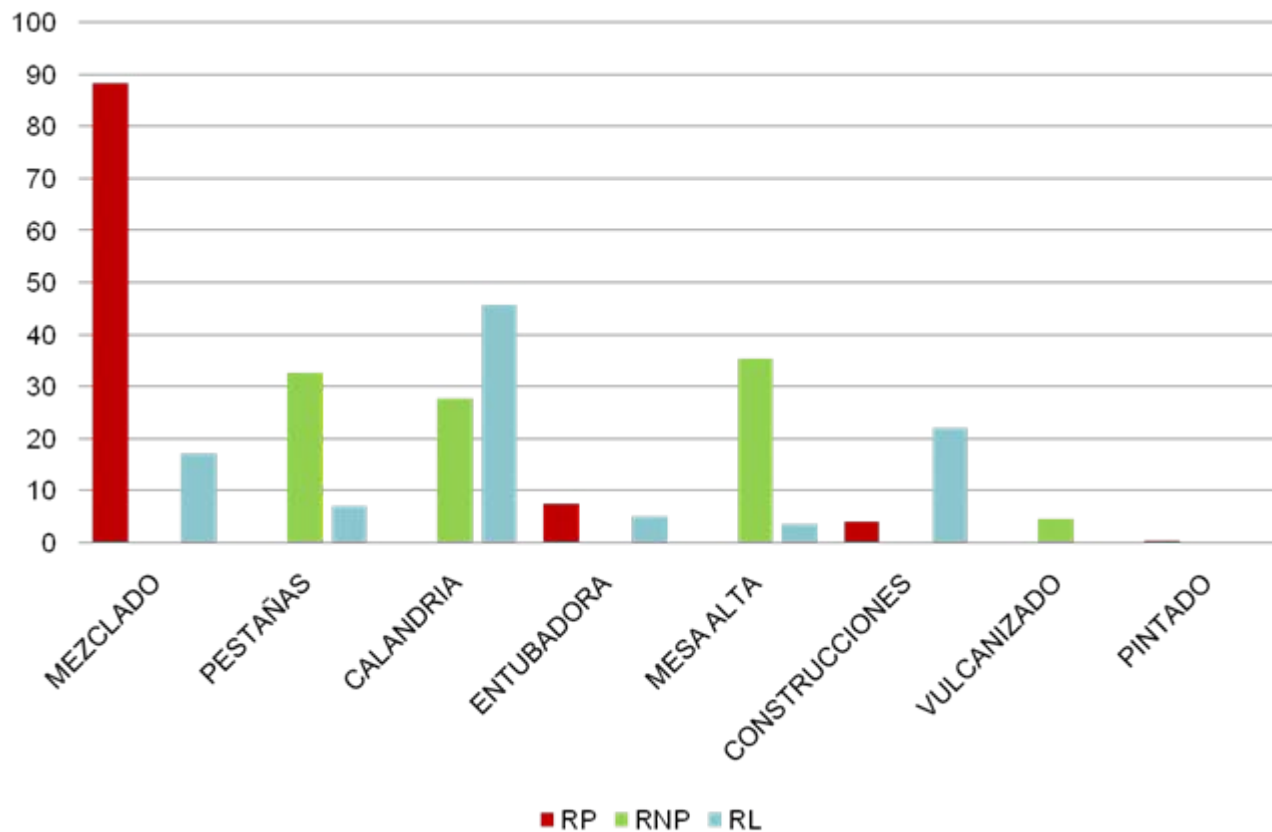
ENTRADAS			SALIDAS	
<b>Recursos</b>				
Lubricante interno	1631,6667			
Lubricante externo	1008,3333			
Cemento	8319,3333	<b>MEZCLADO</b>		
Pintura (identificación de rodados)	35,086343			
Piunta llantas	2100	<b>PESTAÑA</b>	<b>Residuos</b>	
Energía (BTU)	5685,6928		Residuos sólidos peligrosos	5629,714
Electricidad (KwH)	249246,58	<b>CALANDRIA</b>	Residuos sólidos no peligrosos	5997,714
Bunker 6 (gl)	2091,5833		Residuos líquidos (lt)	317,5
Gas Natural m3	2763,8192	<b>ENTUBADORA</b>		
Nitógeno Kg	69769,167		<b>Emissiones</b>	
Agua (gl)	434,09917	<b>MESA ALTA</b>	CO	154,18
<b>Materia Prima</b>			NOx	437,135
Pigmentos	2183312	<b>CONSTRUCCIONES</b>	SO2	1191,695
Caucho sintético	8729718			
Caucho natural	3918582,8	<b>VULCANIZADO</b>		
Aceites	1302561,7			
Tela	5843,7278	<b>PINTADO</b>		
Texina	195409,58			
Alambre	590216,51			
Negro de humo	6871995			
Silical	123087,02			



# EMISSION (ug/m<sup>3</sup>)



# WASTE



# Conclusion

- Inventoriy of all the process,
- Reduce 10% plastic packaging.
- It identified the area of greatest generation of spill and reduced the frecueny of maintenace.
- Change of fuel: Diesel for Natural Gas.
- Recycling water.
- Dust Collector in the Banburies.
- For all of these actions, we can reduce our waste disposal cost.
- More Environmental education

## **1 tire consumes:**

0,042 Lt of water

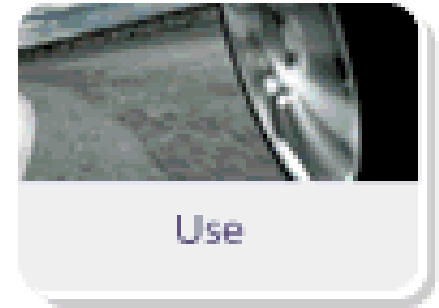
0,071 m<sup>3</sup> of fuel (Then change for 99,7% GN)



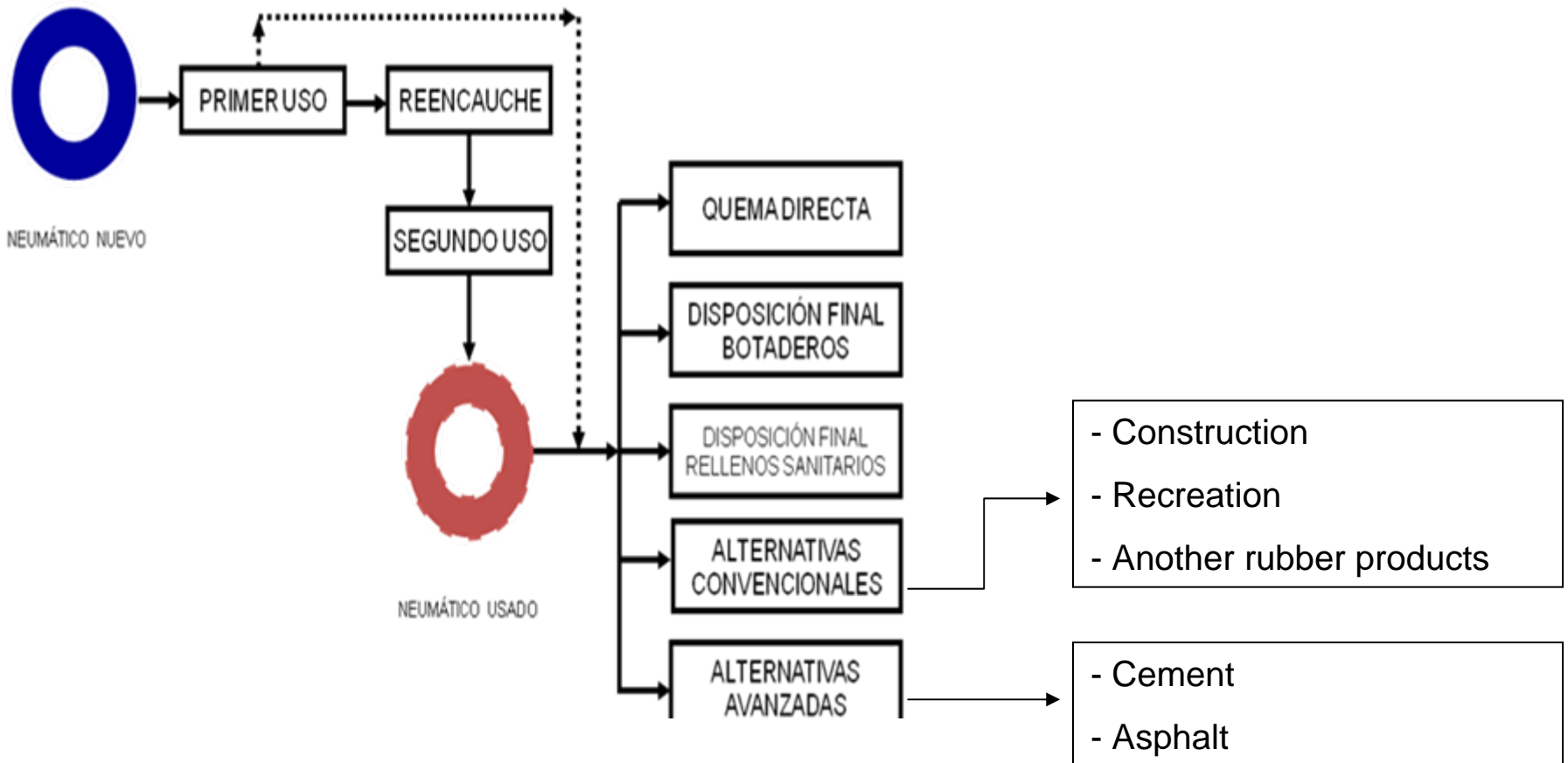
# Weaknesses

1. There isn't an inventory of our country (Peru-Latin American).
2. There isn't priority of the impact categories.

# NEXT STEP



# NEXT STEP



# Thank you

RED PERUANA CICLO DE VIDA

E-mail: [red.acv@pucp.edu.pe](mailto:red.acv@pucp.edu.pe)

[www.blog.pucp.edu.pe/redperuanaciclodevida/](http://www.blog.pucp.edu.pe/redperuanaciclodevida/)

