PROCESSUS GLOBAL POUR RECYCLAGE DE COPEAUX D’ ALUMINIUM

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Energétique

Environnemental

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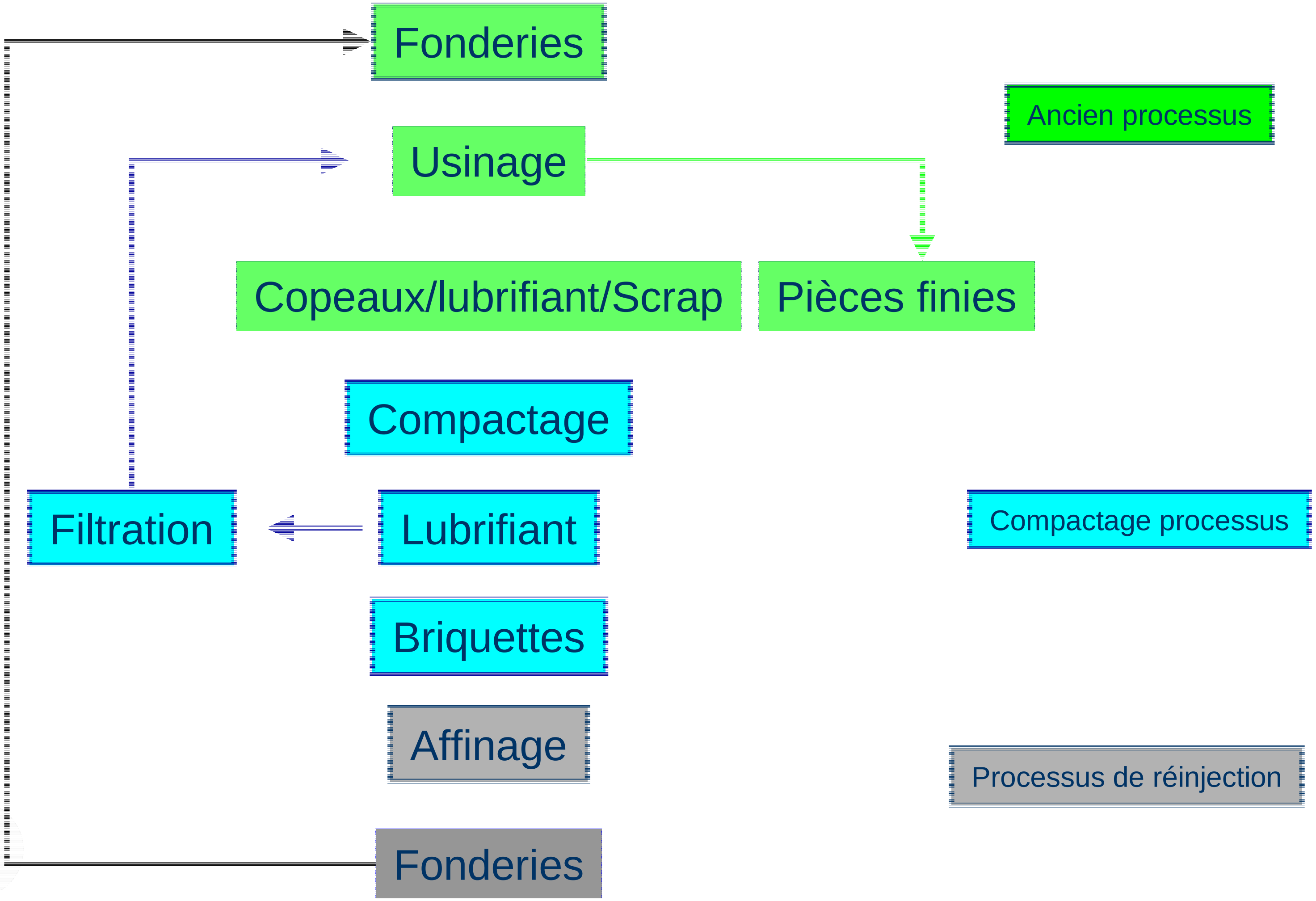
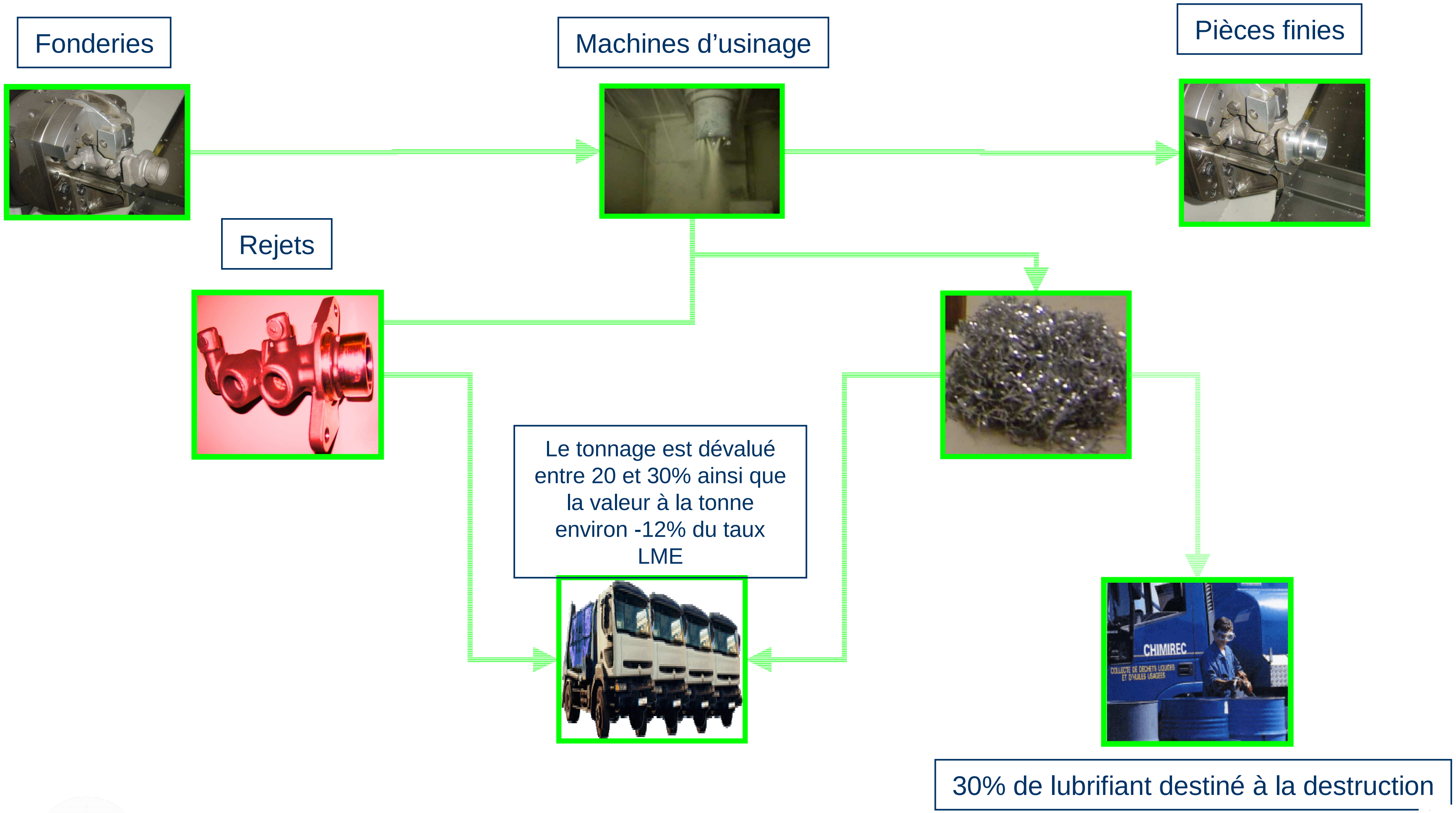
DEROULEMENT PROCESSUS

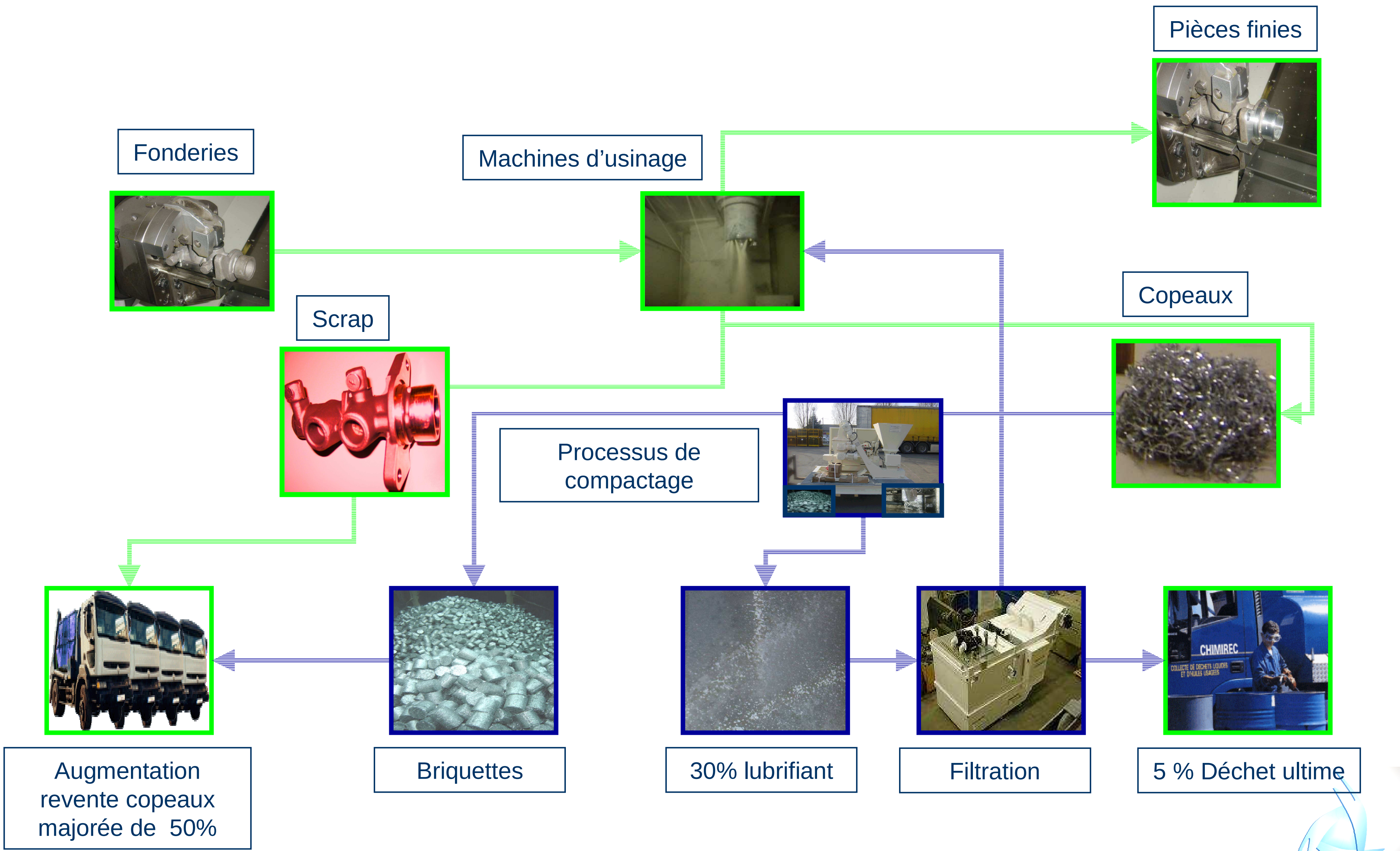
TROIS ETAPES DE RECYCLAGE



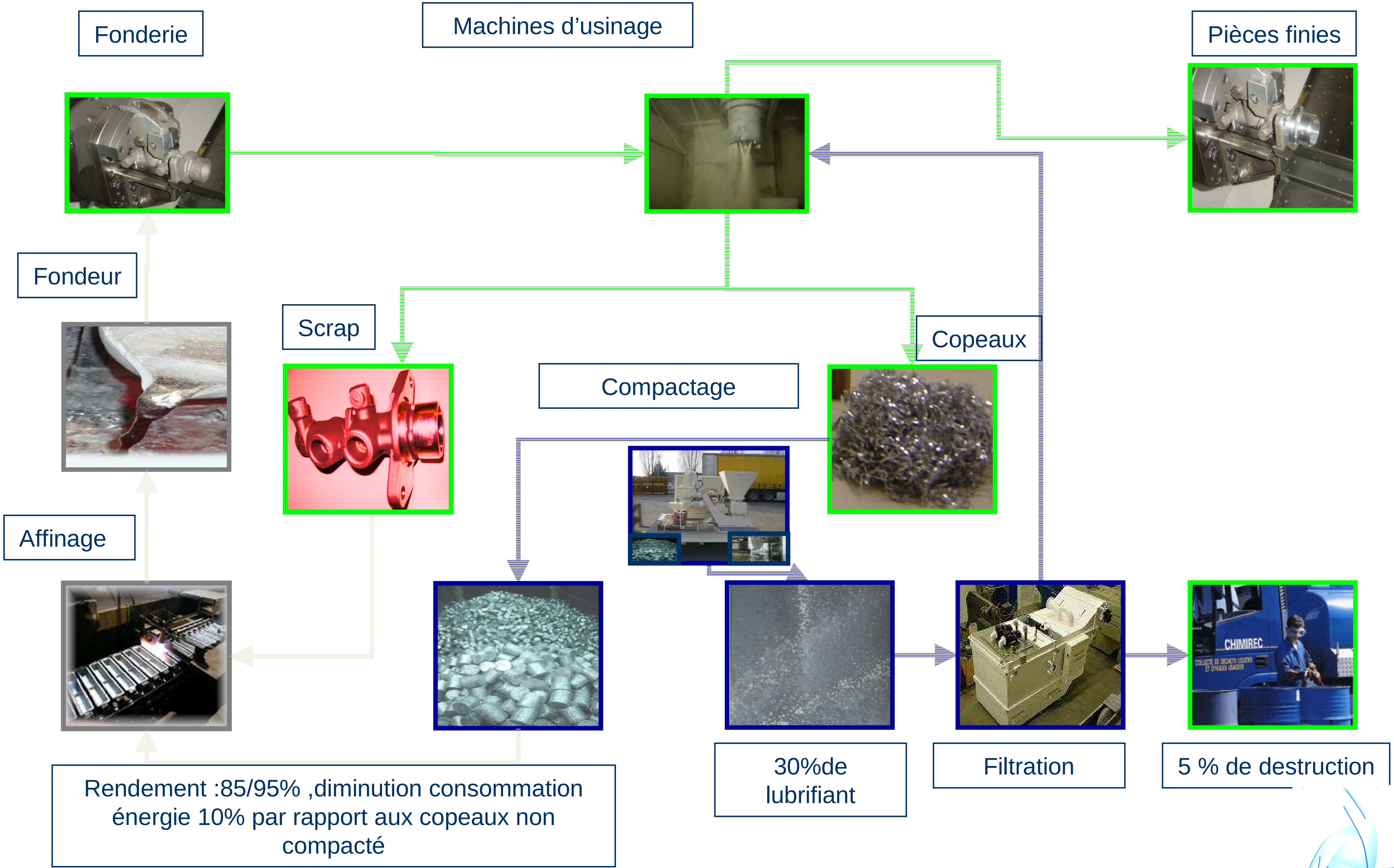
ANCIEN PROCESSUS



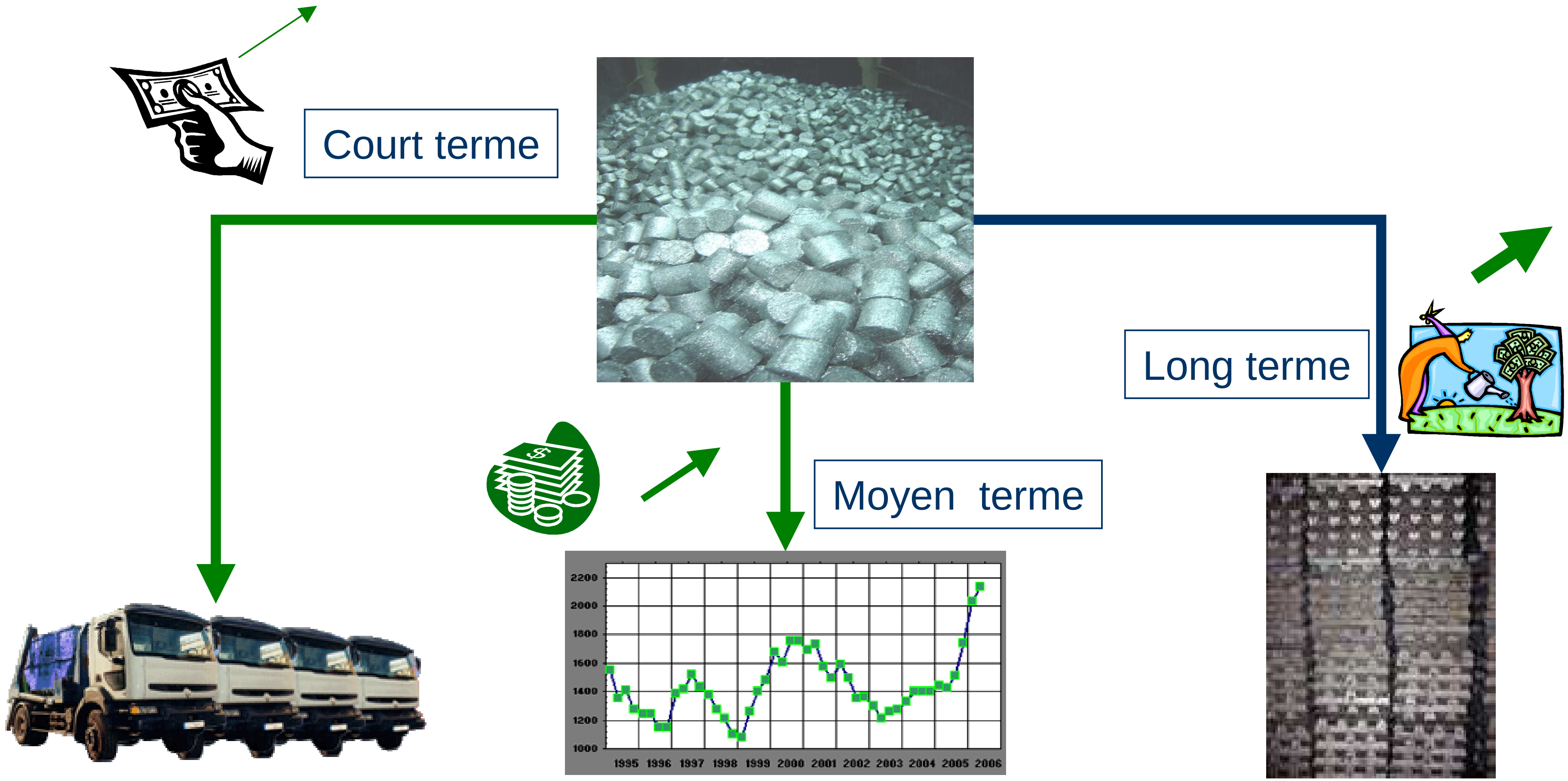
PROCESSUS DE COMPACTAGE



PROCESSUS GLOBAL



Trois directions possibles pour les 30% de matière compactée



APPLICATIONS

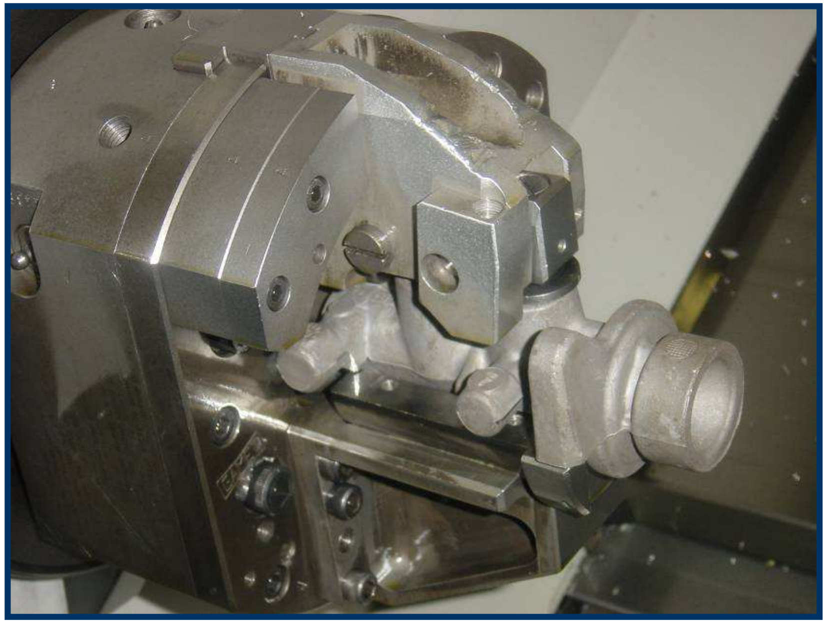
PROCESSUS DE COMPACTAGE

USINE DE VILLERON

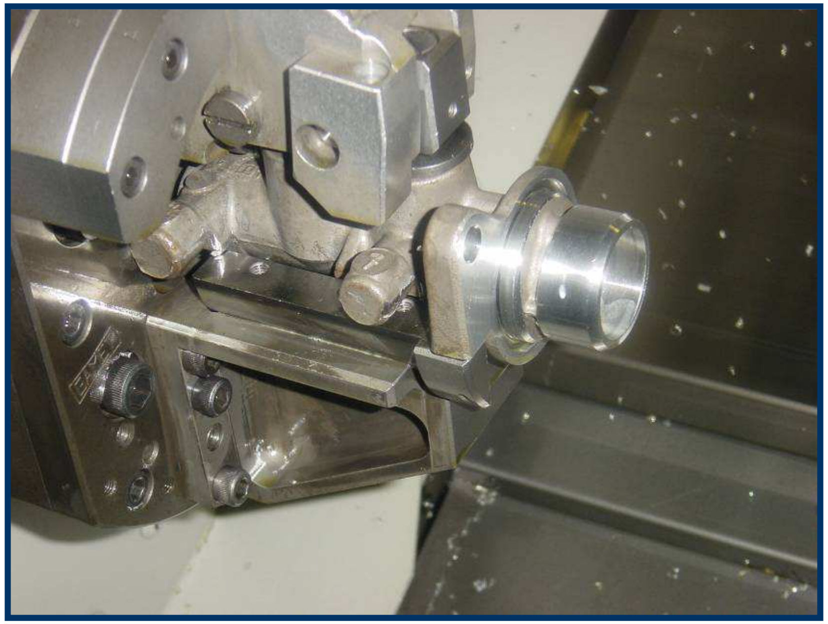
VILLERON

Politique environnementale
Réduction des coûts de gestion des déchets

PRODUCTION MAITRE CYLINDRE AS7G

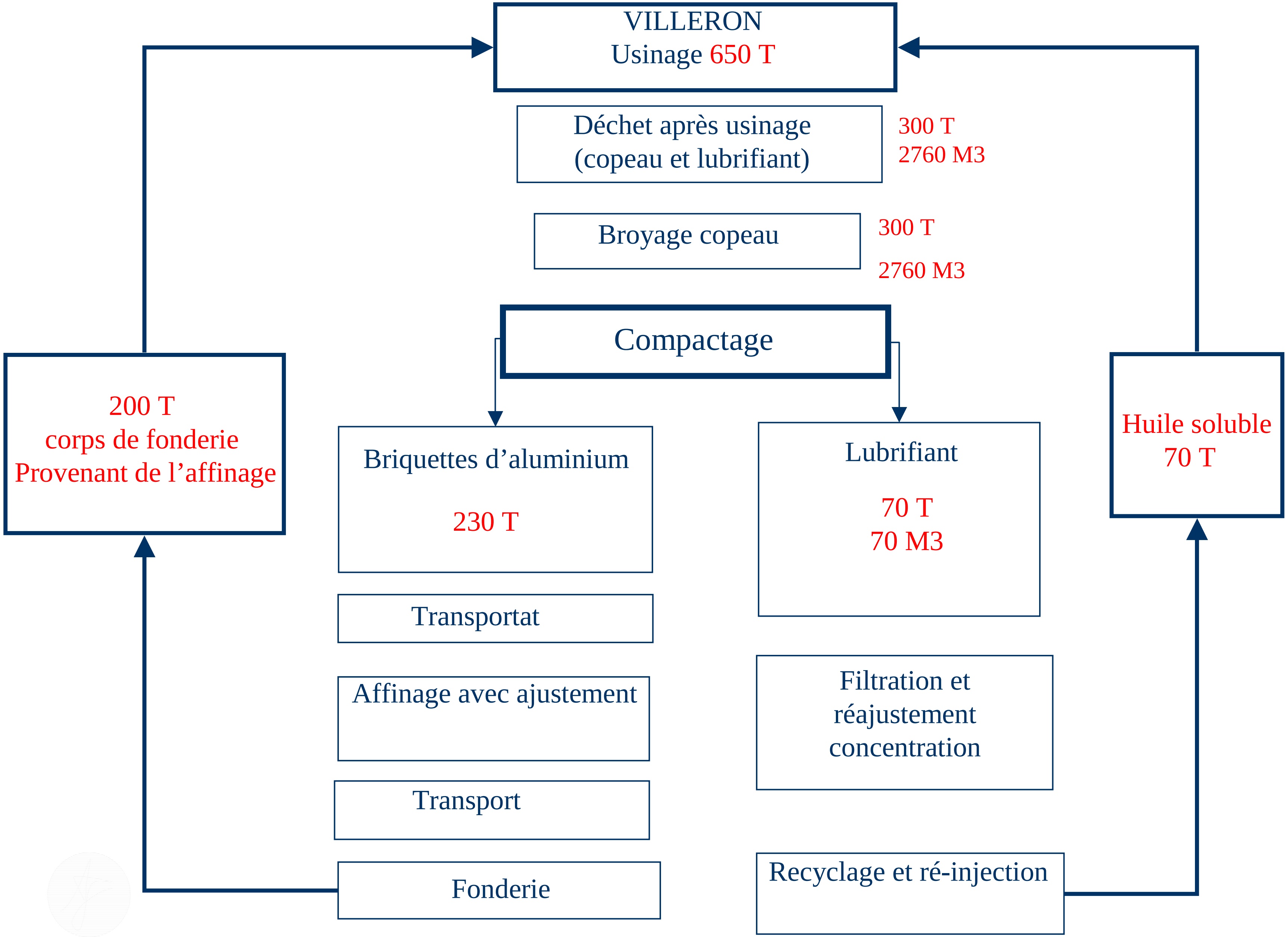


Fonderie 500 GR



Pièce usinée 345 GR

Copeau 155 GR


VILLERON
Usinage 650 T
Déchet après usinage
(copeau et lubrifiant)
300 T
2760 M3
Broyage copeau
300 T
2760 M3
Compactage
200 T
corps de fonderie
Provenant de l'affinage
Briquettes d'aluminium
230 T
Lubrifiant
70 T
70 M3
Huile soluble
70 T
Transportat
Affinage avec ajustement
Filtration et
réajustement
concentration
Transport
Fonderie
Recyclage et ré-injection

EQUIPEMENT

Station de compactage

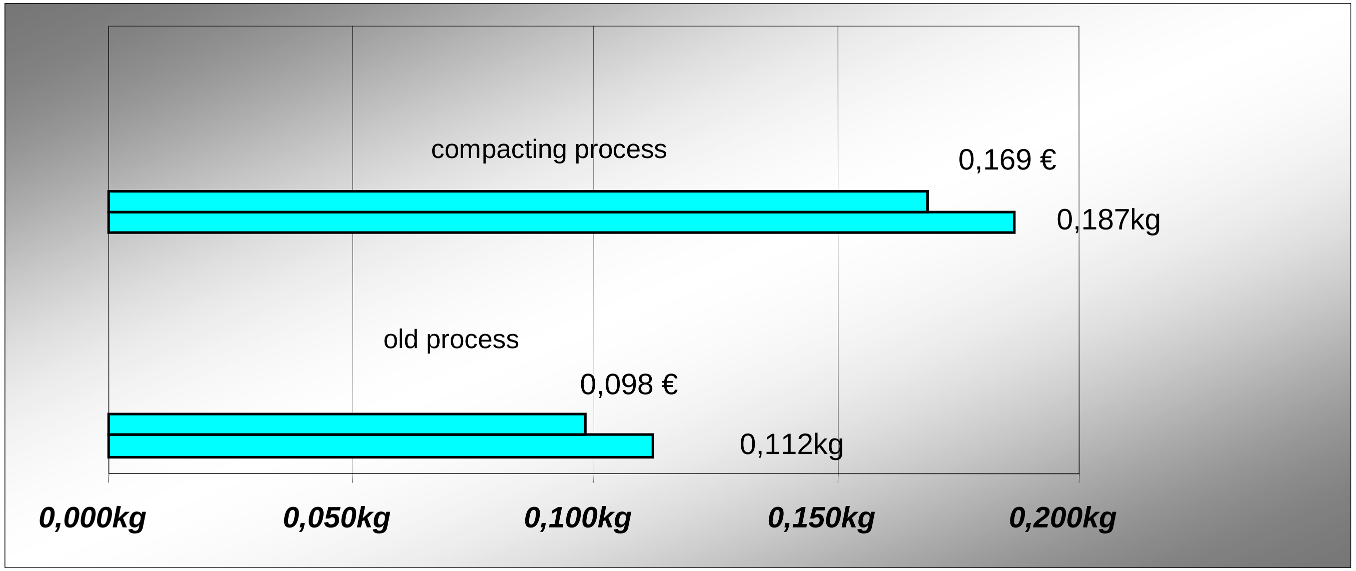
station de filtration

RESULTATS

RESULTATS NE PRENANT EN COMPTE QUE LE PROCESSUS DE COMPACTAGE

BILAN REVALORISATION MATIERE AVEC COMPACTAGE						
PERIOD	BEFORE COMPACTING PROCESS 2001/2002			AFTER COMPACTING PROCESS 2002/2003		
	Product parts	invoice volum	Invoice	Product parts	invoice volum	Invoice
JUILLET	103 240p	11 363kg	10 844,00 €	10 998p	kg	0,00 €
AO Û T	46 240p	8 505kg	7 533,00 €	30 209p	kg	0,00 €
SEPTEMBRE	110 240p	11 953kg	10 224,00 €	87 642p	18 980kg	17 651,00 €
OCTOBRE	98 900p	12 527kg	10 277,00 €	82 268p	10 300kg	9 632,00 €
NOVEMBRE	72 760p	8 243kg	7 138,00 €	82 722p	24 520kg	23 522,00 €
D É CEMBRE	52 560p	5 135kg	4 488,00 €	56 598p	8 920kg	8 442,00 €
JANVIER	98 160p	9 164kg	8 247,00 €	76 103p	10 740kg	9 756,00 €
F É VRIER	95 980p	9 483kg	8 629,00 €	79 295p	17 640kg	16 304,00 €
MARS	99 100p	11 168kg	10 386,00 €	87 696p	11 920kg	10 729,00 €
AVRIL	111 520p	11 957kg	10 632,00 €	79 746p	20 060kg	17 245,00 €
MAI	83 680p	8 802kg	7 482,00 €	63 518p	11 540kg	9 809,00 €
JUIN	83 340p	9 805kg	8 039,00 €	76 010p	12 080kg	10 268,00 €
JUILLET	p	kg	0,00 €	45 447p	13 605kg	11 564,00 €
TOTAL	**1 055 720p**	**118 105kg**	**103 919,00 €**	**858 252p**	**160 305kg**	**144 922,00 €**
MATERIAL PER PART	0,112kg			0,187kg		
SAVING PER PART IN €	0,098 €			0,169 €		
MATERIAL SAVING	***64 291kg***					
SAVING IN €	***60 441 €***					
WITHOUT COMPACTING PROCESS 2001/2002						
TOTAL CORRECTED	1 055 720p	197 188kg	178 266 €	Material saving per part	66,96%	
LOSS MATERIAL	***79 083kg***			Financial saving per part	71,54%	
LOSS MONEY IN €	***74 347 €***					

Gains tournures entre l'ancien processus et le processus de compactage par pièce

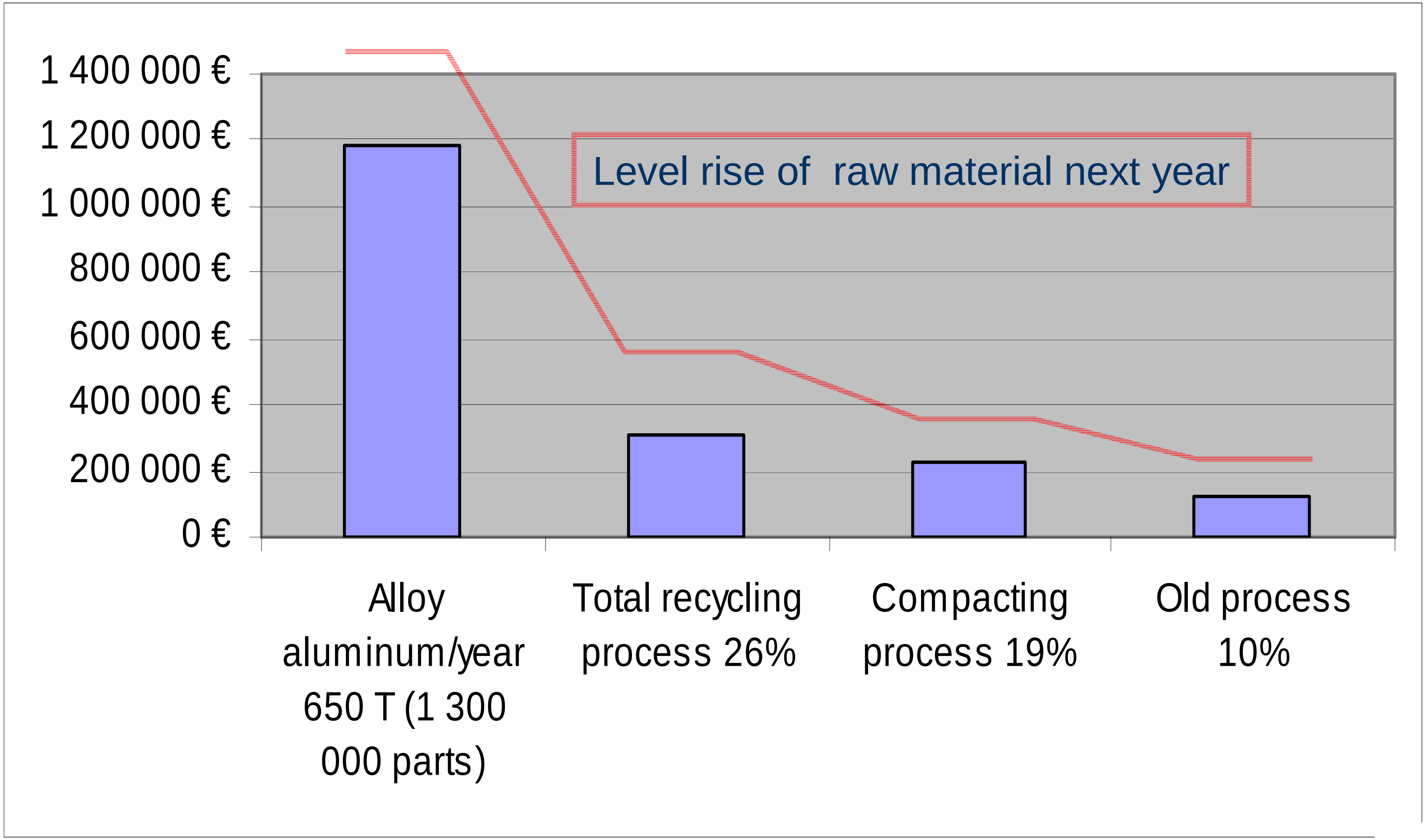


Retour sur investissement

Global coast:		**81500€**
Savings :	Volume evaluation july 2002/ july 2003: **878 849 P**	
12%	Increase of the selling cost of the compress aluminium turnings LME 58% increase 70%	17 772 €
	Increase of the selling cost of the frame of the master cylinder LME 63% increase 70%	1 297 €
58%	Earning of the total volume	42 287 €
	Recycling of the oil/water volume to treat	2 948 €
	Reduction of the oil/water volume to treat	9 465 €
	TOTAL	**73 769 €**
Note:	There is a possibility to get a subsidy from "Agence de l'eau"(the water agency)	
	The level of subsidy approaches 50% of the total investment.	42 200 €
	The loaning rates approaches 30% of the total investment.	24 450 €
	TOTAL	**66 650 €**
Pay back period :	Without subsidy:	
6 months	(Total investment/total saving)x12	
	(81 500/73 769)X12 = 13,26 months	
93,50%	**With subsidy:**	
	(81 500 - 42 200)/ 73 769)x12 =6,39 months	
	With subsidy+loaning:	
	(81 500 - 66 650)/71 324)x 12 =2,49 months	

COMPARAISON

Estimation des gains matière AL après vente copeau et scrap



Deuxième étape
Affinage /Fonderie

- 2004 démarrage test d'affinage, résultats conformes et le rendement est près de 70% pour unéchantillon de 10 Kg
- Pour l'affineur avec un volume de 10 tonnes le rendement pourrait être d'environ 90%/95% selon son expérience
- Le coût à la tonne de l'affinage est de 520€
- Le gain d'énergie pour lui est d'environ 12%.
- Les essais n'ont pu se poursuivre car le site de Villeron a été fermé en 2006

Rapport affinage

AFFINERIE D'ANJOU

LE PIQUERON 49490 LINIERES BOUTON TEL : 02-41-82-61-90 FAX : 02-41-82-30-06

FAX MESSAGES

DESTINATAIRE : STE DELPHI
A l'Attention de : Mr.JACQUES

EXPEDITEUR : Michel Valéry

DATE :19-11-04 Nbre Page(s) : 1/1

Objet :PROJET ESSAIS AFFINAGE DE BRIQUETTES DE TOURNURES D'ALUMINIUM. .

Monsieur,

Suite à notre conversation téléphonique du 18-11-04, veuillez trouver ci-dessous, notre meilleur offre de prix pour la transformation de vos briquettes de tournures aluminium (qualité A57G06 Sb).
Le prix s'entend marchandise réceptionnée aux Affinerie d'Anjou.
Mise en œuvre de la transformation dans les règles de l'art incluant le transport vers la région parisienne.
Prix : 520 €/T
Donnée technique : Suite aux différents essais sur l'échantillon que vous nous avez fourni, (10 kg) nous avons trouvé les résultats suivants :

- Rendement moyen = 70%
- Analyse type moyenne :

Si %	Fe %	Cu %	Mn %	Mg %	Ni %	Zn %	Ti %	Pb %	Sb ppm
7.20	0.16	0.01	0.08	0.33	0.005	0.06	0.11	0.008	1100

Nota : Des essais devront être effectués sur une quantité plus importante afin de confirmer les résultats ci-dessus, sachant que nous trouvons le rendement relativement faible.

Nous vous en souhaitons une bonne réception.
Nous vous prions d'agréer, Monsieur, nos sincères salutations.

La Direction
Michel Valéry

Deuxième exemple de la compagnie RUF

Briquetting Melt Experience

Introduction

During sawing, scalping and finishing of aluminium billets, T-bars, slabs, extrusions, and die castings, the generation of swarf is an unavoidable by-product. When this swarf is remelted in either rotary furnaces or reverb melters, typical melt loss is in the region of 18-30%, or rather the recoverable metal from this swarf is 70-82%. In some exceptional cases the recovery can be in the range of 90%, but this very much depends on the moisture content of the swarf generated. This moisture can either be in the form of soluble oils for machining lubrication or lubrication oils for saw blades.

In most cases, metal loss is attributed to four factors:

A Moisture content of the given material
B Charging of the material into the melting furnace
C Oxidation already present on the charge material
D Density of the charge material

The best way to maximize the recovery for the swarf generated is to process it into a form that can be easily melted. The best process is to briquette it or, rather, compress it, into high-density briquettes or slugs.

Maximising Recovery From Aluminium Swarf

As previously mentioned, typical recoveries from aluminium swarf generated from finishing processes and billet saws vary tremendously depending upon bulk density, moisture content, and oxidation of the charge material.

Due to the high affinity of aluminium to oxygen and the comparative large surface area of swarf in relation to its mass, substantial metal losses can occur from the melting of loose swarf, even if it is dried prior to melting. Tests that a customer of RUF GmbH & Co KG undertook with on some 10 metric tonnes of material (swarf) have shown that the metal loss, due only to natural oxidation when exposing the loose swarf to fresh air, can be in the range of 2.5 to 4% during the first week alone.

This means that irrespective of melting procedures and operating practices, if loose swarf is subjected to exposure to fresh air for one week, the melt loss will be 2.5 to 4%.

On the other hand, swarf briquetted immediately after generation does not have the opportunity to oxidize and the metal loss relative to these briquettes has been shown to be less than 2%.

Additionally, when the generated swarf is subjected to briquetting, the majority of the moisture is extracted and used in the actual briquetting process to provide lubrication to the compression chamber. At the same time, the swarf is compacted into exceedingly high density briquettes, which when melted, display the same re-melt characteristics as solid metal such as ingots, crop ends, and sows. It is these three functions, high compression, reduction off oxidation, and reduction of moisture present that drastically increases recoveries of the product form 70 – 82% up to 97% and greater.

Feeding Material Into the Machine

Usually, swarf briquetting machines are located underneath cyclone type units that act as exhaust mediums from the billet saw or finishing process.

When fed in this manner, the swarf does not have the chance to oxidize and the metal units that would normally be lost to oxidation are preserved.

In some certain cases, as with flying saw operating on HDC T-bar, further processing prior to briquetting is required. This is for two reasons. Firstly, the amount of swarf generated from a single cut is too great for the briquetter to handle in the regular operating mode, and secondly, in some cases the swarf generated can be stringy. If this is the case an additional swarf accumulator hopper and simple shredder can be placed in-line with the discharge of the saw exhaust system and the in-feed to the briquetter.

Once the swarf generated has been passed through the shredder, the unit is able to maximize cycle times as the swarf is now uniform and relatively small in size.

In some cases, some clients instead of instantaneously briquetting the product prefer the benefit of ease in handling and reduction of storage required for a given quantity of swarf. It could be that there is a large feed hopper supplying the briquetter. The feed hopper is fed with swarf that is collected from billet saws. Although the oxidation on the swarf occur, the briquettes are produced within a few hours of the swarf being produced, and as such, still realizes better recoveries than before, but not as good as they could be.

Another benefit from the briquetting of swarf is the increase in bulk density and the reduction of collection bins required for the same amount of swarf generated. For instance, one particular costumer has reduced the amount of storage bins from fifteen down to one for the same weight of swarf. This increase of density also means that shipping costs are now reduced as one container can easily hold the required 20 to. Under normal conditions with regular swarf, the most that could be transported by truck was 10 to. Due to the bulk density of the generated material.

Melting and Charging Practices

Obviously, as with all melting of aluminium and scrap, charging practices and furnace operating parameters can have a drastic effect on melt losses. The best way to achieve high melt recoveries, irrespective of charge material, is to avoid exposure to oxygen and to melt quickly.

There are two very different ways to re-melt briquettes to achieve exceedingly high recoveries. These two methods of re-melting depend upon the source of the swarf. For instance, the way in which secondary billet saw swarf is melted is different than that of primary aluminium swarf generated at an aluminium smelter. This is simply because the types of re-melt furnaces and resources are different.

Rapport de la compagnie RUF

Primary Aluminium Smelter Swarf

When primary aluminium swarf is briquetted, the briquettes are placed into the holding furnaces of the casting process. Once charged into the furnace, molten metal direct from the pot line is poured over the briquettes. Since the molten metal completely covers the briquette, and the density of the briquette prevents them from floating, the briquettes melt almost instantaneously. This method of melting results in the highest recoveries possible from the re-melting of briquettes. It has been demonstrated that actual metal losses for the briquettes when melted can be lass than 1%.

Secondary Aluminium Billet Swarf

Since secondary aluminium plants do not have the possibility of adding molten metal to a charge (in most cases), the way in which briquettes are melted in a secondary reverb furnace are somewhat different to that of a primary plant.

When charging briquettes generated from secondary aluminium billet, the briquettes should be charged into the furnaces as if they were loose swarf. This is to say, at the bottom of the charge. The remaining scrap and solid metal should then be placed on top of the briquettes. Once the charge is complete the furnace should then be operated in the normal manner. Since the briquettes have such a high density, the re-melt properties of these are virtually the same as sows and ingots. As this is the case and the melt is relatively slow, the recoveries from these briquettes are lower than those of the primary plants. However, compared to the recovery from melting loose swarf the briquettes provide a much higher recovery. It has been demonstrated that melt loss under this scenario is in the region of 3%.

Another option for the re-melting of secondary briquettes is to re-melt them in a tilting rotary furnace. To date we have no actual data on the recoveries, but it is very safe to assume that the recoveries from re-melting briquettes would be the same, or very close to, the recoveries experienced when re-melting solid ingots.
Return on Investment

Typical loss (metal) from loose swarf =15%
Typical loss (metal) from briquettes = 2%
Metal recovery increase =13%

Talking these figures and applying them to a typical swarf generator (billet producer casting 50,000 tonnes/year

Product Mix:
20,000 tonnes of 602 cm. logs = 37.000 logs
30,000 tonnes of billets (68,6 cm.) = 490.000logs

Cutting With ¼ + 10%

Therefore, the length of cuts is equivalent to 490.000 + 37.000 x ¼".

This equates to 368,930 m of aluminium. Since one cm of an 8" diameter billet weighs 0,95 kg/cm , then the weight of swarf generated is approximately 354.000 kg per year.

Taking into consideration the previously stated metal recoveries, if this particular billet processor melted the swarf in conventional ways, they would realize the yield of 85%. This would equate to a recovery per year from the swarf of almost 301 to.

Using the briquetter on the same volume of generated swarf, the client would recognize a yield of 98%. This would equate to a recovery per year from the same swarf of approximately 347 to.

This shows in this example a metal savings of 46.000 kg per year. Based upon a value of $ 1.8/kg (alloyed, since the briquettes can be treated as solid alloyed material and not general scrap), the savings would be almost $ 83.000 in metal units alone. In addition to these metal unit savings, there are other benefits. Shipping and handling costs are significantly reduced. Also, this allows for easy separation and storage of the briquettes according to alloy type.

Conclusion

When loose swarf is briquetted to a high density there are several major benefits. These are:

- *Much higher metal yield, typically 15% or greater*
- *Easier handling*
- *Alloy segregation*
- *Briquettes have a much higher metal value than loose swarf.*

It has been our experience at over 400 installations around the world, the briquettes have to be high density or else the benefits stated cannot be realized, as the oxygen can still infiltrate the product an oxidize the swarf. Also unless the briquettes are dense, they simply float when entered into a bath of molten aluminium and higher metal losses are realized.

In order to achieve the best recoveries from briquettes the following properties are desired:

- High density
- Quick compaction after generation
- Small uniform size for the swarf entering the briquetter device (to ensure high throughput)
- Good melting and charging practices

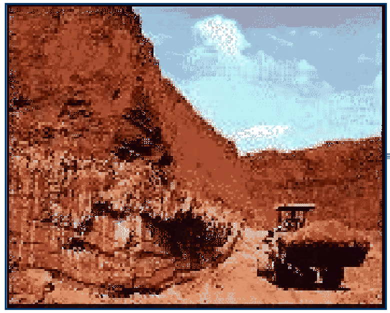
Informations techniques

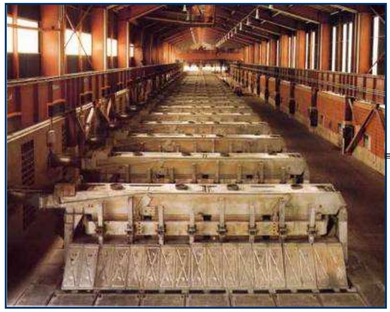
Informations concernant l'extraction et l'élaboration pour une tonne d'aluminium primaire

- Energie : 20 000/25 000 KW
- Matière: 4/6 tons bauxite
- Produits chimiques:4 tons
- Gas généré : 1 ton GES(CO/CO2/HAP/SO2)
- Eau: 80/100 M3
- Déchets:3/4 tons
- Etc………

Bauxite extraction et traitement

Extraction

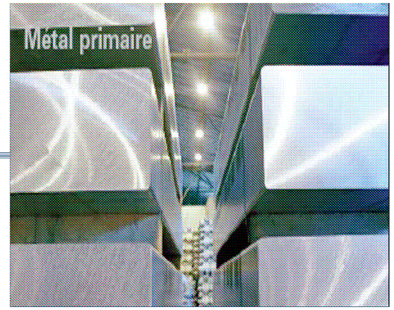




Déchets

Processus aluminium

AL primaire

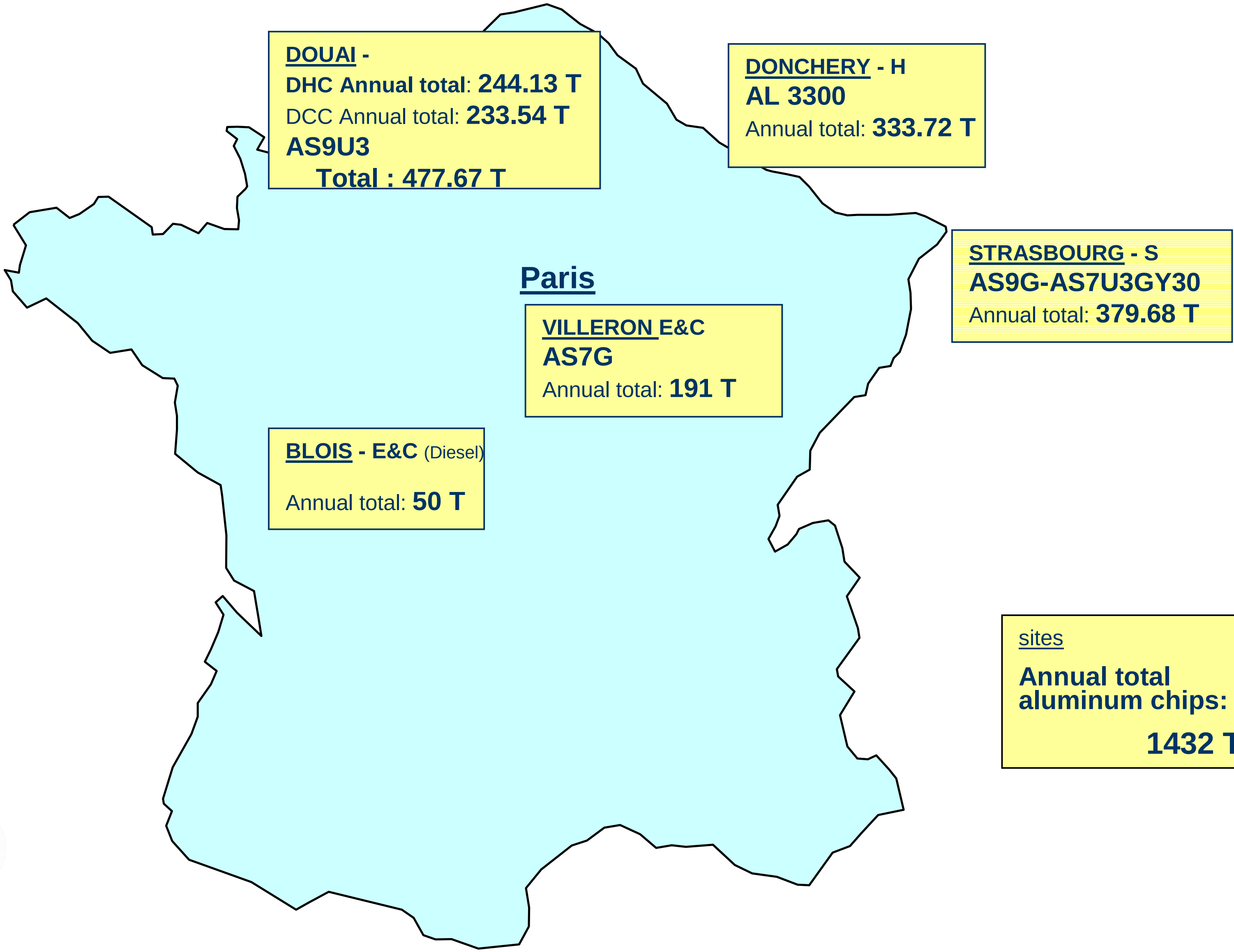


Proportion des déchets après compactageaprès compactage

Informations générales

- Consommation gas oil pour un camion:40/50L/100 kms
- Coût destruction des déchets :300€/1000L
- Concentration d'huile de coupe :8/10%
- Prix de l'huile de coupe :4€/kg
- Densité briquette :2,7
- Taux d'humidité: inférieur à 2%
- Cour des métaux en augmentation depuis 5 ans entre: 20% , 60%/ an
- Consommation moyenne d'aluminium par Américains :22 kg
- Consommation moyenne d'aluminium par Africain:0.7kg
- Le recyclage utilise 20 fois moins d'énergie pour l'élaboration d'une tonne d'aluminium primaire

Total copeau aluminium   FRANCE 2002



sites

Annual total aluminum chips:

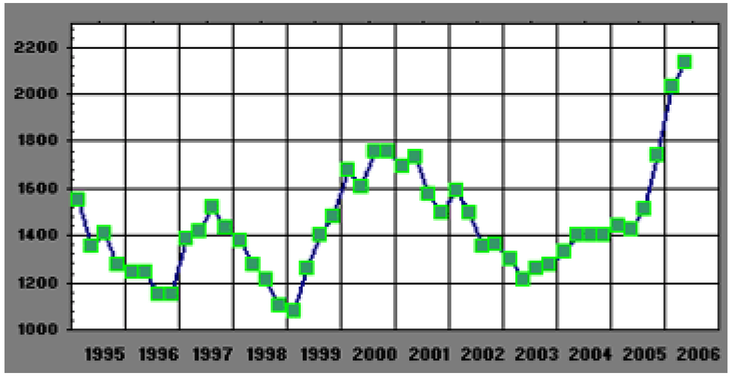
1432 T

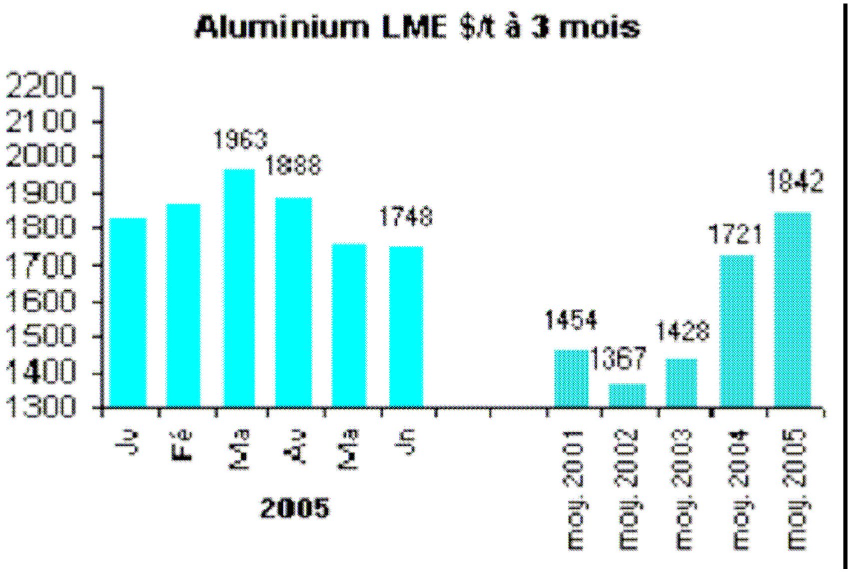
Economie

Informations économiques

Reuters 2006 analyst price forecast poll (cash, US$/t)						
	Barcap	Consensus	Revision	High	Low	Range
Al	2350	2110	20%	2425	1896	28%
Cu	4550	3788	41%	4769	3000	59%
Pb	1080	942	18%	1102	827	33%
Ni	14600	12821	-3%	14561	10000	47%
Sn	7000	6693	-7%	7275	6000	21%
Zn	2000	1736	33%	2205	1001	120%

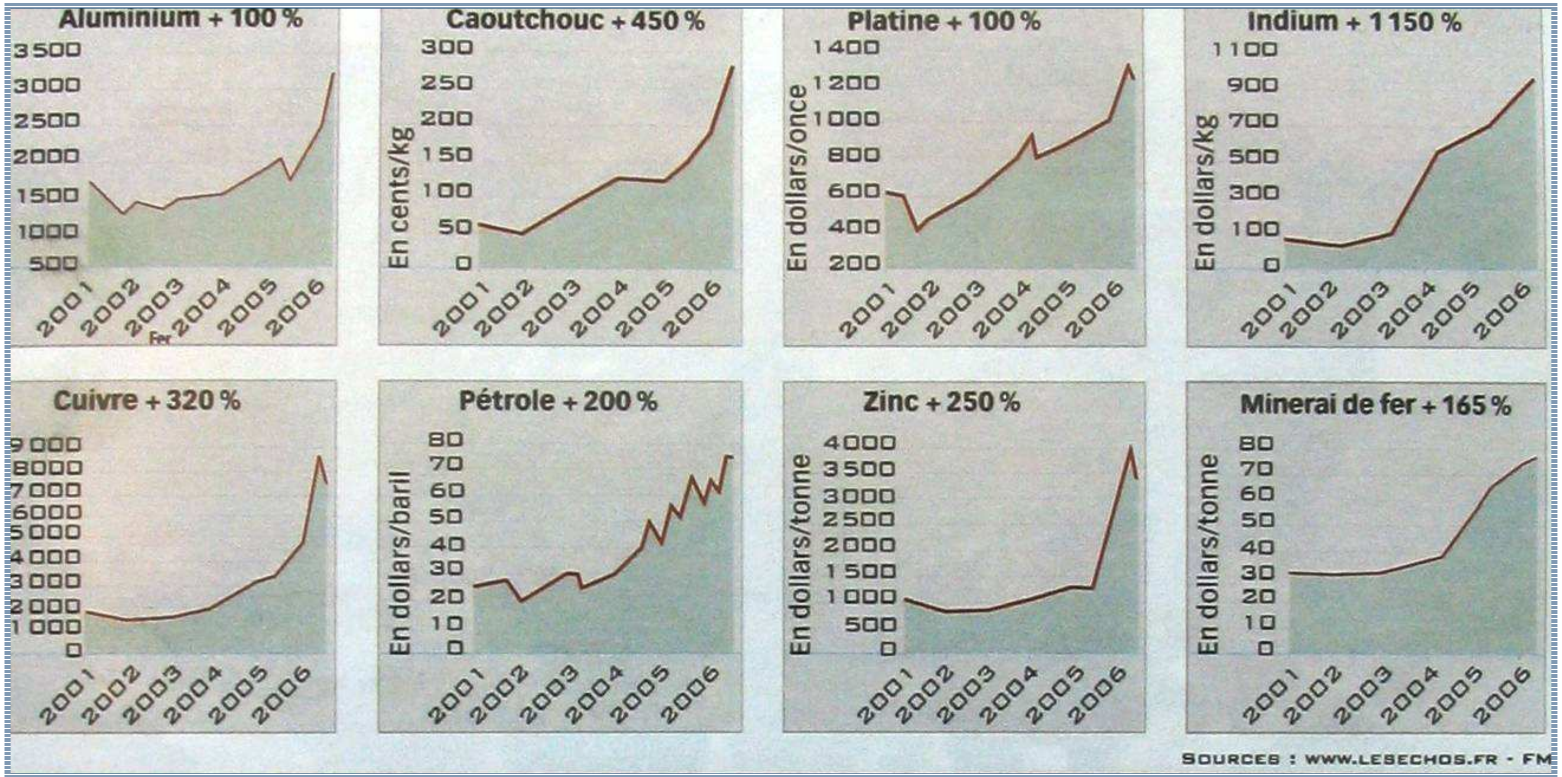
Source: Barclays Capital. Note: % revision from July 05 Reuters poll; range is the % difference between high and low forecasts.





Informations économiques

A quelle vitesse les cours progressent-ils ?



Informations environnementales

Estimation réserve matière première monde

MÉTAUX	RÉSERVE (EN KT)	DURÉE APPROXIMATIVE
Argent	570	28 ans
Cuivre	940 000	63 ans
Fer	180 000 000	118 ans
Indium	6	13 ans
Nickel	140 000	93 ans
Or	90	37 ans
Platine	80	184 ans
Plomb	140 000	43 ans
Uranium	4 743	85 ans
Zinc	460 000	45 ans
ÉNER. FOSSILES	**RÉSERVE (EN TEP)**	**DURÉE APPROXIMATIVE**
Charbon	509	230 ans
Gaz naturel	143	70 ans
Pétrole	140	50 ans

SOURCES : USGS - OCDE/NEA - OBSERVATOIRE DE L'ÉNERGIE - BP

Conclusions

Avantages

1. Divise les transport par 8/10 *(énergie, finance) impact direct*
2. Ré-évaluation du prix de vente de 10/12% *(finance)* impact direct
3. Humidité négligeable en dessous de 2% *(énergie) impact indirect*
4. Exactitude de la masse de copeau généré grâce au procédé de compactage (*finance, audit financier) impact direct*
5. Très peu d'égoutture récupération 20% à 30% *(environnement ,taxes , déchets , destruction, coût lubrifiant) impact direct*
6. Facilité de stockage *(finance ,logistique, financial audit financier) impact direct*
7. Les besoins énergétique pour l'affinage ne représente que 5% par rapport à l'élaboration d'aluminium primaire, car matière compactée *(finance) impact direct*
8. L'opération d'affinage avec des briquettes à un besoin énergétique inférieur de 12% à 15% et le rendement est meilleur voir rapport *(finance, energie, environnement) impact direct*
9. Perte au feu inéxistante avec des briquettes *(energie, environnement) impact direct*
10. Possibilité de ré-utilisé 80% à 90% de cette matière en tant que matière première , controle des coûts de production *(finance, coût, engineering) impacte direct*

Impact environnemental

- 6 % de la matière première sont destinées à l'industrie (production totale d'aluminium primaire : 22 591 000 tonnes pour 2005) *(finance ,environnemental) impact direct*
    - Imaginons si nous appliquions qu'1% de ce processus ; le gain serait d'environ 9000 tonnes d'Aluminium primaire =45 182 tonnes de bauxite etc….;si vous voulez calculer les répercussions reportez-vous aux informations. (*finance , environnement, energie) impact indirect*

Avantages généraux

- La matière affinée est semblable à la matière première
- La différence de prix entre la matière primaire et l'affinage est de l'ordre de 1000€/T
- Il est possible d'appliquer ce processus global à toutes matières (acier,fonte et particulièrement aux métaux non ferreux).
- Quelques sites DELPHI et fournisseurs appliquent partiellement ce procédé.
- Ce projet a été présenté lors d'un audit ISO 14001 , et a été subventionné par l'Agence de l'Eau Seine-ormandie
- Vous êtes moins dépendants des fluctuations des cours matières,vous pouvez maitriser 20% de votre matière première (celà représente ce que vous générer en tournure)

Subventions& Organismes

Les subventions que vous pouvez obtenir

- Environnemental
- Energie
- Agence de l’eau
- Europe

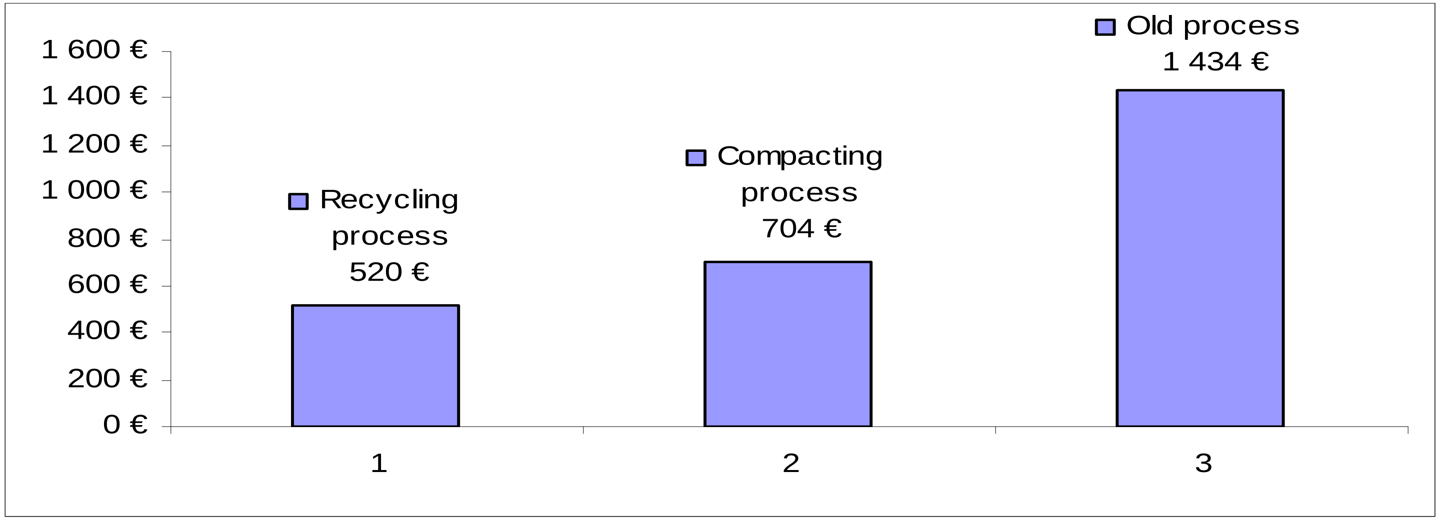
Subventions

- Avec le processus global ,vous avez pusieurs directions pour protéger l'environnement et avoir des gains supérieurs à 40% par rapport à l'ancien système de revente des copeaux.
- J'ai essayé de vous fournir un certains nombre d'informations qui vous seront nécessaires pour obtenir des subventions ou emprunts à des taux très bas voir nuls.
- Si vous constituez un bon dossier,vous obtiendrez des aides de l'état , ainsi votre retour sur investissement peux s'étaler entre 6 à 12 mois(exemple de l'agence de l'eau:70% de subvention sur le matérien , 30% pour l'étude , possibilité d'emprunter 30% du prix global sur le matériel sur 10 ans à taux 0%)

Prix d'achat d'une tonne d'aluminium après revente ou transformation des tournures

Cour aluminium primaire LME 2400€/t
Alloy Aluminum rate LME 2550€/t
Prix affinage 520€/t
Exchange rate 1.26

Ce calcul est simplifié il ne prend pas en compte les retombées énergétiques et environnementales



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