The Pennsylvania State University
University Park Campus

ArcelorMittal

Waste Stream Reuse and Recycling

EDSGN 100
Section 002

ArcelorMittal

Design Team #8

Design Team Name
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SECTION 1 EXECUTIVE SUMMARY

There are lots of waste during the steel-making process in ArcelorMittal which could be reduced or recycled. Our team choose to deal with the used pallet which creates a lot of waste lumber. Our objective is to recycle the lumber by reprocessing. We decide to buy the recyclers, the wood processing machine, hire more workers and start a new business to recycle the lumber. The waste wood will be transferred to new pallets and wooden furniture, which could be reused by the company or sold to the market. According to our research and analysis, starting a new business to recycle the lumber is both feasible and beneficial.

SECTION 2 INTRODUCTION

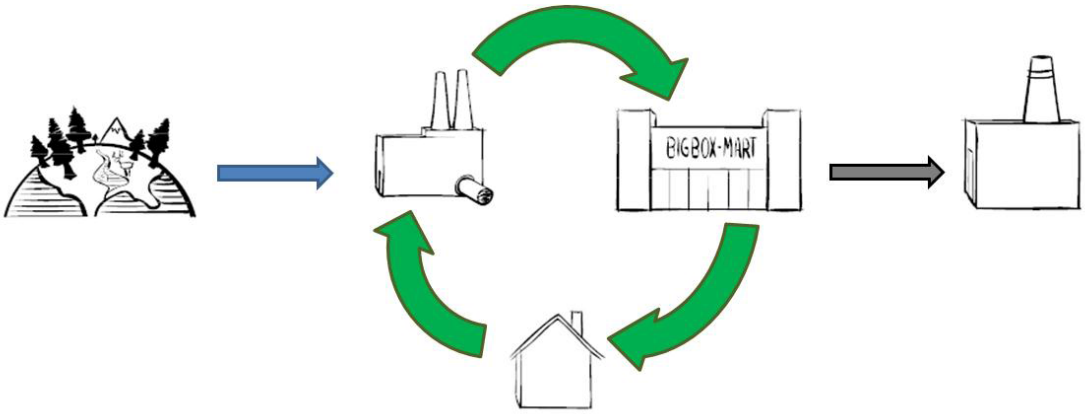
2.1 PROJECT OBJECTIVES.

Reduce ArcelorMittal's waste stream at one of its facilities by designing an opportunity to reuse and/or recycle one or more of the largest sources of reuse: pallets from incoming material delivery, empty drums or totes received from delivery of fluids, and waste refractory brick.

2.2 PROJECT BACKGROUND.

Steel is one of the most common materials used by modern societies. It is also a good example of a resource with large known reserves that are finite. As with most of the finite resources we utilize, our industries that use iron and steel initially developed a linear production cycle (see figure below, from www.storyofstuff.org), often referred to as "Cradle-to-grave." Given that iron is seemingly abundant in the Earth, it was common for steel to be disposed of like everything else: in a landfill.

Imagine, then, that, in this project, we are contributing to taking the linear cradle-to-grave process and making it a cyclical "cradle-to-cradle" process. By recycling most of our materials over and over again, we greatly reduce the strain on resources and on waste disposal. For the greatest impact, this must be combined with lowering growth in consumption, eventually reaching a steady-state or even shrinking consumption.



Use of recycled steel has been a part of the steel industry since its beginnings, with major efforts made in war-times when resources were scarce. While steel is often recycled effectively, some of the byproducts of production are not. Many steel companies are able to sell the slag produced in the process of making liquid steel for roadbed filler, and some also sell the iron oxide mill scale byproduct. ArcelorMittal espouses company values of Sustainability, Quality, and Leadership. In support of the value of sustainability, we look to reduce our overall waste stream to improve the sustainability of our processes. Also, reducing the amount of waste will, in turn, reduce disposal costs, and improving profitability also helps the long-term sustainability of a business unit.

2.3 SPONSOR BACKGROUND.

Our partner in this project is ArcelorMittal USA, the largest steel producer in North America and the largest integrated steel producer in the United States. ArcelorMittal is the leader in all major global steel markets, including automotive, construction, household appliances, and packaging. It is the world's largest and most global steel company by both revenue and production, with over 285,000 employees in 60 countries. ArcelorMittal operates in three divisions in the USA: Flat Carbon, Long Carbon, and Tubular. The Steelton, PA, plant is in the Long Carbon division. Similar to the other Long Carbon plants, the Steelton plant manufactures steel from recycled scrap metals. This plant has a liquid steel-making capacity of about 1.1 million net tons of steel per year. Product lines include cast and rolled blooms for the forging and re-rolling industries; rails for railroad, transit, and crane application; rolled billets, squares, and flats; construction equipment sections; and large diameter specialty ingots.

2.4 PROJECT CATEGORIES.

Through the process of electric furnace steel-making the outputs produced are baghouse dusts, liquid steel, slag, and waste refractory brick. The souse of major waste from this process is the refractory brick. Which is one area that needs to be studied to possibly find a better way from this source to be used. Refractory brick is also a source of waste with the reheating and rolling process needed for steel production. Two other general plant waste products that will be studied to reduced the waste is drums and waste lumber. The waste lumber normally being in the form of old and broken pallets.

2.5 PROBLEM STATEMENT.

We choose the waste product of the extra lumber to study further and come up with a solution. The main source of the waste lumber is pallets. Which are used to protect, transport, and store goods. The average dimension of a pallet used inn the steel business is 40”x48”. Which creates a lot of waste lumber when the pallets begin to be old and start to break.

SECTION 3 METHODOLOGY

3.1 SUSTAINABILITY.

Sustainability is the ability to continue.

Sustainability is about the future of our globe. While fulfilling the tremendous amount of social needs, sustainability requires us to also take environmental limit into account so development can still be maintained for future generations and the resources would not exhaust in the globe.

3.2 RATIONALE FOR SELECTION.

Human development throughout the years has shrunk down a large area of forest, and the problems followed are not only the shortage of lumber, but also the loss of habitats, change of climate, the decrease of self-sustainability of the environment and other ecological issues.

Recycling re-usable wood thus becomes one of the most important tasks to maintain the sustainability of global environment by reserving habitats and reducing forest cut down.

3.3 DESIGN CONCEPT.

The main topic of recycling the lumber in the production of ArcelorMittal is recycling the unusable wooden pallet. Since the pallets become unusable mainly due to some of the broken parts, recycling the wood in the pallets can be done by repairing the broken parts, resembling into a new pallets or wooden furniture and then selling them back or reusing.

An alternative way to recycle the pallets would be rebuilding the broken pallets into crude containers for simple storage such as yard containers.

3.4 REGULATORY ISSUES.

Since ArcelorMittal is recycling their own broken pallets, repairing and reusing or reselling, the only legal regulatory issues may be encountered is to make sure to report the revenue of selling the repaired wood and submitting corresponding taxes.

No environmental issue would be encountered since the action is environmental favorable, which leads to a minimized disposal created.

3.5 STAKEHOLDERS.

ArcelorMittal would definitely benefit from the concept by reducing waste disposal of the broken pallets and the cost of purchasing of new pallets

The company who is doing the repair-resemble-resell process can also a stakeholder of the concept since it can purchase the broken pallets at a very low price or even recycle by free, and then benefit from selling at a high price after simple repair-resemble process.

3.6 ASSESSMENT OF AMOUNT OF WASTE DIVERTED FROM LANDFILLS.

Most of the pallet wood can be recycle in this way by renewing them or transforming them into furniture and other wooden decorations. Except the pieces of wood that is broken into too small, all the rest of wood can be recycle and rebuild. Thus, 95% of the waste estimated can be diverted from the landfills.

3.7 ECONOMIC ASSESSMENT.

Designed cost:

Machine cost:	
About $5000 each, 5 machines in total.	$25,000
Worker payment:	
$25,000/yr for each worker, 5 to 6 workers in total	$150,000/yr
Land cost:	
$2500 /acre, ⅔ acre needed	$1,700
Shipping cost:	$5,000
Misc. Cost:	$5,000
Designed total cost	**$186,700/yr**

Revenue:

Selling resembled pallets:	
$15 / pallets, 50 pallets sold/ day	$195,000/yr
Profit:	**+$8,300/yr**

Past cost:

New pallet cost:	
$25/pallet, 5000 pallets needed per year	$125,000/yr
Disposal cost:	
Shipping disposal:	$5,000/y
Total past cost:	**-$130,000/yr**
Total Balance:	**+$138,300/yr**

3.8 SYSTEM DIAGRAM/MODEL.

Rotary Pallet Dismantler

The Recycler (pictured to the right) is a machine that would be needed to optimize the the process of recycling the pallets. The machine cuts the bottom of the horizontal beams. The beams after being cut have to be analyzed to determine if the beams can be used again in the production of a new pallet.

Pallet Doctor Station Platers

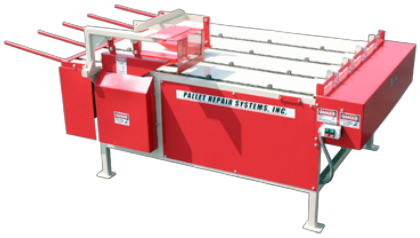
This machine always needed is used to assemble the pallets. Once the pieces from the various other machines are broken apart and are evaluated for strength. If the pieces pass the evaluation this machine is used.

Pallet Repair Mechanical Repair Station

The innovative Mechanical Repair Station removes nearly any broken deck board from stringer type pallets at the push of a button. Powerful pneumatic cylinders are actuated by the operator to remove an individual board quickly and effortlessly. The removed board drops from the pallet into a collection bin, or on to an optional belt conveyor for removal and the operator moves on to the next task.

Trim Saws

This machine would be used to trim the extra lumber that is deemed strong enough to be used in the production of a new pallet. The pieces run through the machine and it cuts the edges to make sure that they are the same and correct length.



Lead Board Removers

This needed machine is used to cut the horizontal beams on the top and the bottom of the old pallet. The boards after the y are cut will be inspected and tested for strength. Then will be sorted in terms of if they can be used to make a new pallet or if they are too weak and will be disposed the previous way.

3.9 ENVIRONMENT IMPACTS.

The disposal of the used pallets would either occupy a large area of space or the burning of them could lead to a large amount of emission of green house gases. Also, in order to replace the used pallets, new pallets have to be made out of extra cut down of wood, which is an unnecessary loss of forest, and the extra processing of new cut down wood can lead to more disposal of waste and use of energy.

Since the wasted pallets are recycled and rebuilt, there would be less disposal of woods, and less cut down of the wood in order to make new wooden devices. Since the manufacturing process for recycling the pallets in our design is just simply taking the used pallets apart physically and also resembling physically, the extra energy would be consumed would be the electricity that runs the machine and the metal or glue to resemble the parts, which can both be regenerated and cause minimal disposal.

3.10 PRODUCT DEVELOPMENT AND MARKETING.

The production of the design is the repaired pallets, which is processed by first taking the recycled pallets apart and then resembling the functioning parts back together. Most of the repaired pallets would be used back by AcrelorMittal and the extra is sold to the other factories, which are the major market of the used pallets, since most used pallets are as the new ones but much cheaper. The target selling price is $15 per repaired pallets, and it is estimated that about 50 extra repaired pallets can be made each days. The product should be launched by first collecting a certain amount of extra repaired pallets, say two-week production, and then packaged and send to targeted factories.

The advertisement would mostly be on the Internet as an extra section of product or byproduct of ArcelorMittal, which can be viewed by the target audience, the factory or company who is coming to buy the metal and seeking a container to hold the metal.

SECTION 4 SUMMARY

There are lots of benefits to start the new business and recycle the lumber by the company itself. Since it's their own business, plenty of cost could be reduced. The cost of raw materials is free to some extent because they are the company's own waste. There will also be less transportation fees since the new factory should be next to the original one. Besides, the company clearly know the demand of the new pallets so the new factory could adjust their output according to the company's demand, which means the factory will be less affected by the market fluctuations.

However, there is still some disadvantages of implementing our design. Substantial investment to the project is needed to start the new business, such as purchasing equipment, renting land and hiring employments. Therefore, the company may suffer from some losses at the beginning of the investment. Nonetheless, there will be profit in the long run after the company get used to the new project and gain some operating experience.

According to our research, it is feasible to start the new business to recycle the lumber for the company. We investigate the cost of operating machines, lands and labors, and estimate the output and price of the products. Then we find that there are profits to run the business. Besides, in the long run, it is the development and expansion for the company to cover the new business field. Moreover, the company will become more self-efficient than before, which means the company is more prepared and confident to face the market risk. Finally, we conclude that it is both feasible and worth for ArcelorMittal to start the new business.

What's more, this kind of concept could be used by any other companies. When a company has become the expert of the original business, it is hard for it to improve further more. It is time to cover a new ground related to the original one, for example, dealing with its own waste. It is such an effective way to develop and expand the company.

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