ArcelorMittal
“The Bent Levers”
Engineering Design 100
Section 014

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Introduction

The second project given to Bent Levers, Inc. provided a lot of background knowledge on the subject due to its very open description. We were asked to provide the company ArcelorMittal with an idea/process they can use to recycle or reuse three waste products that their company excretes being wood pallets, 50-gallon plastic and metal drums, and refractory brick. The whole point of the project was not to figure out how to incorporate all these products in the company, but to choose which products to either reuse or send to other companies, who would eventually recycle them into useful products. We as Bent Levers, Inc. thought about the possibilities, did research, explored companies, developed concept screenings, and finally chose to take on the challenge of reusing the wood pallets and metal and plastic barrels.

Executive Summary

Our customer has asked us to design a process for repurposing materials such as 50- gallon metal barrels and wood pallets. At Bent Levers, Inc., we are committed to improving the sustainability of the current process that ArcelorMittal uses. Our final design implements recycling procedures that will reuse materials efficiently and overall benefit the company greatly.

Through extensive research, we have found the best possible options for the reuse and recycle of the wooden pallets, and metal drums. First, we have found KAMPS, a company in Ohio that is willing to buy broken and used pallets. We will sell the pallets to them, and also start buying needed pallets from them so that we are always using recycled pallets. Next, we found Royalton Recycling, a company in Middletown, PA that
is willing to pick up and buy scrap metal. This will be a no cost solution in that this company will come to ArcelorMittal's site, pick up the drums, and give us money for them.

There are certain obstacles that need to be overcome in this new recycling initiative. The recycled pallets that we purchase could be of lower quality than the new ones that we purchase now. The quality of the purchased pallets will be looked over before purchasing to ensure that it will be able to perform like the ones used now. This plan will overall increase sustainability for ArcelorMittal and potentially make money for them.

**External Research**

ArcelorMittal is a company who specializes in making and distributing steel from over 60 different countries in the world. As a company, they have accomplished being one of the most well-known and best steelmakers in the world, but what they have not yet mastered is how to become extremely efficient while being so popular. The company gave Penn State money so students who are in Edesign 100 help them out with figuring the best strategies on how to use and reuse certain items that are waste from the steelmaking industry. These items to recycle in some way are used wood pallets, 50 gallon plastic and metal drums, and/or refractory brick.
Wood Pallets:

The wood pallets that ArcelorMittal wants to recycle are not much damaged, if at all, so there are many possibilities on how to reuse and produce another product from recycling. The first option could be to put the used pallets into a wood chipper and use the chips for either heating purposes, mulching, or use the wood chips themselves for a product. Wood chips can be burned to create heat, so powering a stove could be a use of disposing of the wood. Stoves use a lot of heat and the diagram on the left explains how that will work. The wood chips are put in the fuel hopper and the heat is distributed to the food in the oven. This method only disposed of the wood, while using the wood chips for mulch and playground wood chips would require ArcelorMittal to sell the chips to a variety of companies.

The image to the left describes the process of how wood chips are used in a stove.
50 Gallon Metal/Plastic Drums:

The metal and plastic drums have many uses to a steelmaking company including shipping and for waste, but there are many things to do when the drums need to be disposed. There is a possibility to sell them for scrap metal and plastic, or simply sell the whole drums to companies. Almost every company uses these drums, so they will be an easy sell for companies, but used ones must be sold to specific companies who reuse them or clean and resell them. Royalton Recycling is a company in Middletown, PA that will buy the drums from ArcelorMittal for a reasonable price and simply use them for scraps.
The refractory brick is an important part of the steelmaking process because of its resistance to a large amount of heat.

**Refractory Brick:**

The refractory brick that is used for ArcelorMittal has a very high heat tolerance and many people use the bricks for patios and sidewalks. That is the main way to recycle the already used refractory brick, but there is also an additional way to make good use out of the brick. Since the reason for having refractory "fire" brick is to withstand very high temperatures, the alternate use could be for a brick oven or cooking device of some sort. Using this brick would allow ArcelorMittal to make money, while not disposing of the brick, but putting it to good use in the hands of another person. There is a company called Traditional oven that buys refractory brick from companies for the price of $1.98 per brick. This does not sound like a significant payment, but putting into perspective the amount of bricks the company has to offer, there is a decent amount of money that can be made outside of the original product, which is substantial in the business world.
### Needs Statement

<table>
<thead>
<tr>
<th>Needs Matrix</th>
<th>Metric</th>
<th>type of steel</th>
<th>recycle costs</th>
<th>usage</th>
<th>Availability after recycle</th>
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</thead>
<tbody>
<tr>
<td>Wood Pallets to be recycled</td>
<td>1</td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>empty drums/totes recycled</td>
<td>2</td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>waste refractory brick</td>
<td>3</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Use of recycled steel</td>
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<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>sell the slag produced</td>
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<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
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</table>

### Concept Generation

#### Concept Screening

<table>
<thead>
<tr>
<th>Selection Criteria</th>
<th>Refinery Brick</th>
<th>Pallet</th>
<th>Oil Drums</th>
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</thead>
<tbody>
<tr>
<td>Cost (+)</td>
<td>1 (+)</td>
<td>0</td>
<td>0 (+)</td>
</tr>
<tr>
<td>Sustainability (+)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
</tr>
<tr>
<td>Shipping (-)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

| Ranking            | 1              | 1      | 2         |


### Concept Scoring

<table>
<thead>
<tr>
<th>Concept</th>
<th>Waste</th>
<th>Recycling</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Weight</td>
<td>Rating</td>
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<tr>
<td>Sustainability</td>
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<td>2</td>
</tr>
<tr>
<td>Cost</td>
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<td>3</td>
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<tr>
<td>Efficiency</td>
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<tr>
<td>Total</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Rank</td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

### Costs

The two methods we are proposing will not cost ArcelorMittal anything. For the drum recycling, there are no shipping costs because the company will pick up the drums. Also, they are paying for the scrap metal. This money will go towards the shipping costs of shipping the wooden pallets. This will be the only cost in the wood pallet recycling. Proposing ArcelorMittal with the idea of no cost and being able to succeed in their endeavor should not go overlooked. The fact that they can ship the drums and pallets elsewhere, do well for the society, and at the same time turn a profit is a very tantalizing proposal.
The wood pallets are the key recycling output we concentrated on due to its easy manipulation process.
Conclusion

Throughout the whole design process, many thoughts and possibilities came up for consideration, but the Bent Levers, Inc. employees stand by our final decision to use the wood pallets and drums to recycle and make money. Royalton Recycling is a very good corporation that fills the needs of ArcelorMittal because their company is located in Middletown, PA which is close to the ArcelorMittal, and they take the drums to recycle. Another great attribute to Royalton Recycling is the fact that they pick up the drums and take them back to their company for no charge at all, which of course is a bonus. While the drums are going to be recycled, KAMPS will be buying the wood pallets that are also being wasted in landfills. They will take the wood pallets after buying them and refurbishing the wood, and reselling the pallets, but this is also good for ArcelorMittal because KAMPS has a policy where if a company recycles to them, they will provide a discount to that company for new pallets. This will ensure that a savings profit is gained instead of buying new pallets from another company without a discount and getting the additional money from KAMPS buying ArcelorMittal's used pallets. All in all, the process designed by the Bent Levers, Inc. employees is a solid proposal for ArcelorMittal and we enjoyed designing a process for recycling the waste products instead of having them go to landfills.
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