Recycling Plan for ArcelorMittal Refractory Bricks

Edsgn 100

Section 21

Spring 2015

Instructor: Jesse McTernan

Cayla Castells, Ben Apuzzo, Kirby Perosa, Manny Charitos, Natasha Billard

Team: DISC

I. Mission Statement:

Product Description

Figure 1. The refractory bricks that are thrown out by ArcelorMittal after their life cycle.

In order to reduce the amount of waste produced by ArcelorMittal, the 2,565 metric tons of refractory brick waste (as shown in figure 1) each year will be redirected as building materials for community service projects and will be sold for a profit at local hardware stores.

Benefit Production

This solution benefits the the ArcelorMittal both monetarily and in the public eye. The community outreach programs will improve the company's image among potential customers, stakeholders, and members of the community alike. Reusing the bricks reinforces that ArcelorMittal takes the initiative to be environmentally friendly, while simultaneously giving back to the community. The stakeholders will also be supportive of selling the bricks, which will result in a profit for the company.

Key Business Goals

The main business goal is to reduce the waste produced by the ArcelorMittal. Our plan reduces this waste by giving the refractory bricks a second life as building materials. 70% of the bricks will be used for community outreach to improve the company's reputation in the public eye and the other 30% of the waste will be sold for profit at local hardware stores.

Primary Market

The primary market is ArcelorMittal. This plan will help them reduce their waste, make a profit, and look better to the community.

Secondary Market

The secondary markets are hardware stores and areas in need of community service projects. The bricks will be sold to hardware stores for people to purchase as a low cost option for "do it yourself landscaping." The bricks will also be used as parts of community projects in inner cities and parks.

Assumptions

We assumed that the bricks would be in relatively good shape after being used and that they would be safe to touch and to walk on, so as to make good building material.

Stakeholders

The stakeholders regarding this project are obviously ArcelorMittal and the people invested in the company. The stockholders want the company to continue to be successful in making a profit and in helping the community, in order to make a profit themselves.

II. Summary of ArcelorMittal:

ArcelorMittal is one of the 500 largest corporations in the world. Internationally, ArcelorMittal is the leader in steel production, with annual steel production totals reaching over 100.5 million tons. The company's headquarters are in Luxembourg and as of 2015 ArcelorMittal has 232,000 employees throughout the globe (ArcelorMittal PowerPoint). The corporation is not only known for its steel production, but its economic production as well. ArcelorMittal contributed a total of $1.98 billion to the United States economy (ArcelorMittal PowerPoint). Economic contributions aren't the only contributions that the company makes however. They also make significant philanthropic contributions. Their subsidiaries have made substantial contributions to the infrastructure of projects that were built for Brazil's 2014 World Cup, London's 2012 Olympic Games, and they even made donations of steel to the freedom towers in NYC, and their surrounding memorials. Another area of focus for the company is the recycling of water. Since 2006 ArcelorMittal has given $37.1 million in grants for conservation investments to preserve the Great Lakes (ArcelorMittal PowerPoint).

III. Problem Research:

ArcelorMittal is a powerhouse in the world's steel and and mining business. With more than 232,000 employees in more than 60 countries and an industrial presence in 20 countries, they are the world's number one steel and mining company in a variety of steel markets, including but not

limited to: automotive, constructive, household appliances and packaging, and raw materials (ArcelorMittal PowerPoint). As an influential company, they try to maintain a good relationship with both the environment and the community. In order to maintain a good relationship with the community, ArcelorMittal contributed steel to the rebuilding of the World Trade Center as the Freedom Tower, the London 2012 Olympic Games, and the 2014 World Cup in Brazil (ArcelorMittal PowerPoint). As far as being eco friendly ArcelorMittal goes to great lengths to conserve and reuse water. Currently they are involved in a project sustaining the Great Lakes to do just that. Despite this involvement, they are looking to reduce their waste even more.

ArcelorMittal has identified the three main areas where they would like to reduce waste: pallets and other waste lumber, drums and totes, and refractory bricks. Currently all of these objects are thrown out at the end of their life cycle and ArcelorMittal is looking for a way to either reduce the use of these objects or to reuse them. They asked groups to focus on one type group of waste to be reduced. We decided to focus on reducing the waste of the refractory bricks, because they make up the largest type of waste ArcelorMittal currently has.

Through the process of steel manufacturing, ArcelorMittal uses refractory bricks in many ways. Some of the uses include lining the insides of furnaces, Ladle brick for lining of the liquid steel ladles, and runners for steel ingots. These bricks do not last forever and have to be replaced periodically, which produces lots of waste. In 2014 ArcelorMittal disposed of 216 MT of furnace brick, 1586 MT of ladle brick, and 763 MT of tundish brick (ArcelorMIttal PowerPoint). These bricks, being mostly made of clay, minerals, silica, alumina, kaolin, uranium, and thorium, are hard to dispose of. Instead of putting these waste refractory bricks into landfills, ArcelorMittal is looking for these bricks to be used in a different way to reduce the waste and to reduce the cost of disposal.

IV. Decision Making Process

Specific Needs:

We were asked to come up with an idea about how to better reuse and recycle waste materials. We had to make sure our idea specifically helped ArcelorMittal reduce its waste footprint. When considering the connections to the plant and the general community, we found that reusing the bricks in a beneficial way for the community would satisfy both needs by also reducing the company's waste footprint. We also had to make sure our idea was economically viable, met all requirements and met regulatory codes.

Brainstorming Ideas

To brainstorm, we looked at various uses of bricks. We wanted to think of ideas that were both practical and beneficial for the company. Some of the ideas are listed below:

- Build Something
  - Dog house
  - Brick house
  - Outdoor fireplaces
- Create a different material
  - Grind up to make gravel
  - Fertilizer
  - Clay
- Reuse Bricks
  - Clean and use again
  - Bricks that last longer
- Break down bricks using biology
  - Use animals and plants to return the brick to a more natural state
- New Lifting Design
  - Slide under
  - No pallets needed
- Underwater fish house
  - Build underwater habitats for fish and other ocean life

After refining and narrowing down the numerous ideas, we used a matrix to determine whether or not we should continue research. We decided to continue with the underwater house made of bricks for fish, landscaping, and gravel making.

	Concepts						
	A (ref)	B	C	D	E	F	G
Selection Criteria	Throwing the bricks away	Using Biology to decompose bricks	Underwater house made of bricks for fish	Landscape Use/ Outdoor Structures	Gravel	Fertilizer	Reuse
1. Asthetic Appeal	0	-	+	0	0	0	0
2. Cost Effective	0	-	-	+	+	+	+
3. Profitable	0	-	+	+	+	+	0
4. Durability	0	+	+	+	+	-	0
5. Environmentally friendly	0	+	0	+	0	0	+
6. Easy to Produce	0	+	-	+	+	+	-
7. Plausible	0	0	+	+	-	-	-
Sum +'s	0	3	4	6	4	3	2
Sum 0's	5	1	1	1	2	2	3
Sum -'s	0	3	2	0	1	1	2
Net Score	0	0	2	6	3	2	0
Rank	7	5	3	1	2	4	6
Continue?	No	No	Yes	Yes	Yes	No	No

Figure 2. The selection chart above displays how we decided which ideas to further develop. The process included looking at a reference frame and comparing the idea to the reference.

Selection Chart

After determining which ideas to follow through with, we developed the ideas further and compared them using a weighting system. Each criteria was weighted to display how much of an impact the new design would have. The selection criteria clearly displayed that using the bricks for outdoor structures or landscaping would be the most beneficial, outweighing the other options and the reference of throwing the bricks out.

		Concepts							
		Reference Throwing them Out		Landscape Use/ Outdoor Structure		Gravel		Underwater Fish House	
Selection Criteria	Weight (%)	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Asthetic Appeal	13	3	39	5	65	3	39	4	52
Cost Effective	17	3	51	4	68	4	68	1	17
Environmental Friendly	12	3	36	4	48	3	36	5	60
Easy to Produce	18	3	54	2	36	1	18	1	18
Beneficial for the Company	23	3	69	4	92	4	92	5	115
Profitable	17	3	51	4	68	4	68	1	17
	Total Score	300		377		321		279	
	Rank	3		1		2		4	
	Continue?	No		Yes		No		No	

Figure 3. The above selection matrix used calculated weightings to determine which idea should be used for the project.

V. Prototype Planning, Fabrication, and Testing

Prototype 1

For prototype one, we decided to use Google Sketchup to show our various plans for the landscaping and outdoor structure idea. These drawings had various aesthetic designs in order to please a wide range of people. They also show the versatility of the bricks, from plain patios, to firepits. Since they would be sold as just bricks, not as finished products, the consumer could use them however they please. We made prototypes for both portions of our plan: community outreach and development.

Development Prototype

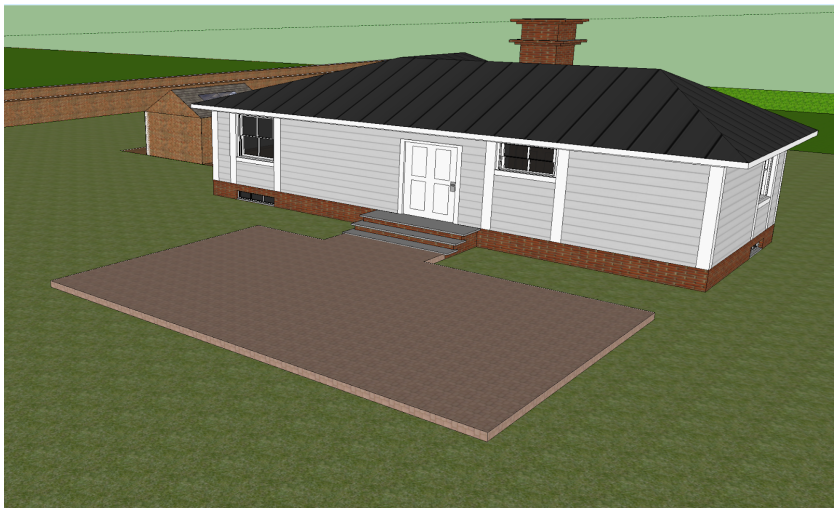


Figure 4. Square patio design

Figure 5. Circle patio and hexago fire pit design

Community Outreach Prototype

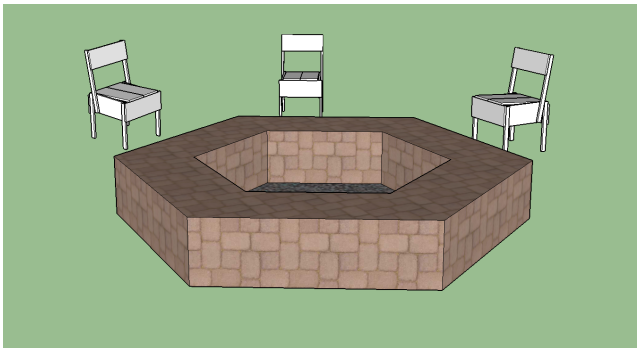


Figure 6. Hexagon fire pit design

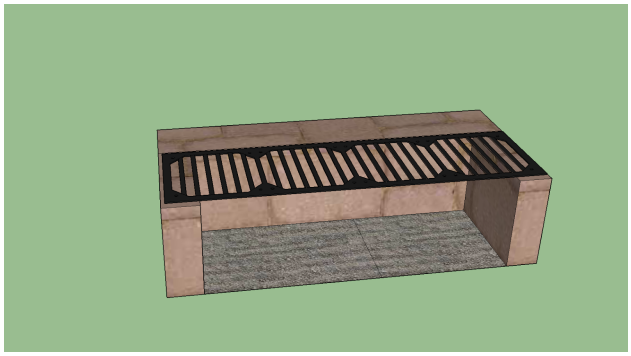


Figure 7. Campfire grill design

Test Results Summary

To test our designs, we asked for feedback from various students. Through an online form, the students were able to vote on their favorite plans and discuss why they liked one over another. For the development prototypes, the results determined that while they liked the designs, they would use the bricks for their own creative ideas. Some customers wanted patios while others wanted walkways. We decided to do the second design for another need: walkways. For the community outreach prototypes, the customers liked the designs for both the grill and the fire pit.

Prototype 2

Alterations

Figures 8 and 9. Prototype 2 being built and assembled.

For prototype two, we decided to keep the main ideas from prototype one, but use a different medium to present them. Rather than a SketchUp drawing, we used a diorama to get a better feel of the design and how it would work.

Figure 10. The finished prototype 2.

Test Results Summary

After completing prototype 2, we once again polled fellow students, to see how they felt about the pathway design. They generally provided us with positive feedback, but once again gave us the impression that while they would invest in the bricks, they would pursue their own designs.

VI. Business Plan

Recycling Plan for ArcelorMittal Refractory Bricks

Objective

To provide alternative uses for the refractory bricks while benefitting both the company and the community.

Basic Model: 70-30 Plan

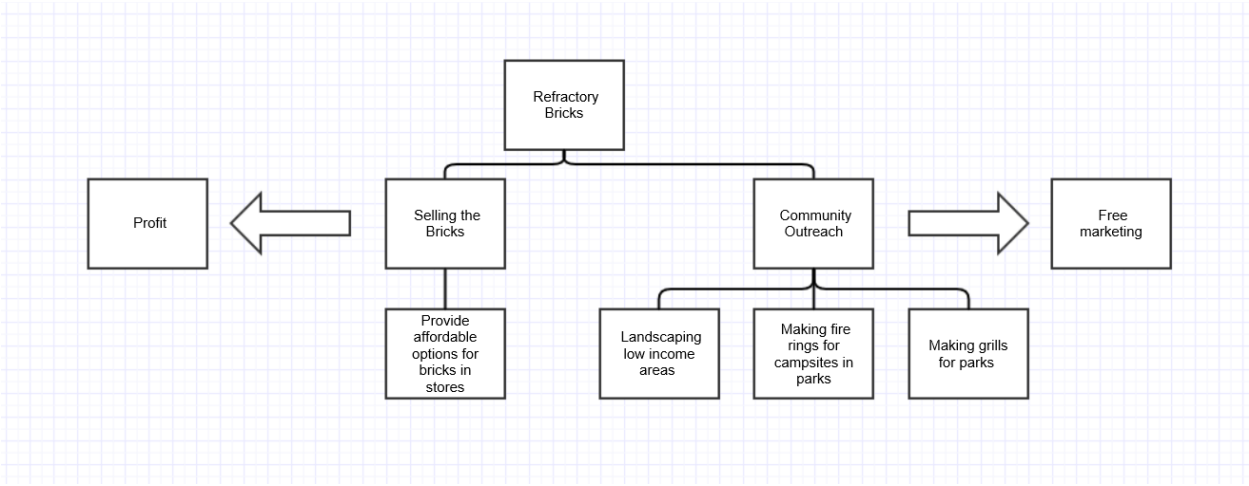
70% of the bricks go towards community service projects

- Campfires at campsites
- Grills in parks
- Landscaping "needy" areas

30% sold at local hardware stores for profit

- For very cheap prices: stores like Lowe's, Home Depot
- low cost alternative for DIY
- Reusing materials, "green" design

Flowchart



Details

The project will consist of two main components: community outreach and revenue building.

The community outreach portion will be split between two main goals: landscaping low income areas, and making various donations to businesses. These donations would include bricks to

make grills for parks and fire rings for campsites and/or parks. Each donation will provide free marketing for the company as well as tax breaks and community service opportunities.

The revenue building will revolve around selling the bricks for profit. Since these bricks are useable for "Do-it-yourself" projects, they can be sold for affordable prices to customers at locations such as Lowe's or privately owned companies. The money raised from the brick purchases can be used to offset the price of purchasing them. In order to maintain the manageable cost for the consumer, the prices will have to be significantly lower than the purchased value. However, receiving any sort of payback will be beneficial to the company.

Financial Expenses

The main expense will be transporting the bricks to various outreach locations. The bricks can be used across the country to help the community. This widespread use provides huge benefits to the company. Significant donations are tax deductible and provide free marketing for the company. Therefore, the price to transport the bricks is outweighed by the added benefits of giving back.

The company will have the opportunity to earn money in addition to benefits by selling the bricks. While at low costs, the bricks can still bring in revenue to the company to additionally offset the price of transportation and use in general.

Costs

Task	**Description**	**Projected Cost (Per year)**
Transportation	● Moving bricks from factory to stores and project sites	● Gas mileage: 7 mpg ● Diesel: $2.50 per gallon ● Distance: 120,000 miles ● Gas cost in 1 year: $42,857 ● Cost of Driver: $37,930 ● 40 drivers hired to begin Total: $3,231,480

Refurbish bricks	● Painting bricks to make them look nicer	● Wage for workers and Paint: $10.00 per hour ● 50 workers to begin ● Working 300 days a year, 5 days a week, 9 hours a day Total: $6,750,000
Installation	● Installing bricks as fountains, fire pits, and landscaping devices, etc. for community projects	● Wage for workers: $14.61 per hour ● 200 workers hired to begin ● Working 300 days a year, 5 days a week, 9 hours a day Total: $39,447,000
		Total: $49,428,480

Benefits

Benefit	**Description**	**Projected Savings (Per year)**
Free Marketing	● Having the company logo around the donation sites ● Social media publicity through the donations and accepting sites ● Marketing costs on average 20-50 percent of net revenue	● Net revenue in 2013 = $2.5 billion ○ $500 million in marketing
Tax Breaks	● Charitable giving tax deduction could be applicable in this situation ● The amount of money saved would be dependant on the amount of projects completed	

Profit from Selling Bricks	● Making profit through the selling bricks ● Customers can purchase the bricks for personal use	● Cost of brick : $1.34 each. ● Average cost of bricks for a small patio: $800 ● Average cost of bricks for walkway: $600 ● Average cost of bricks for fire pit: $100 Total: $15,000 (dependent on amount sold)
		Total: Dependant upon quantity of bricks sold and projects completed each year

Conclusion

The benefits of selling and donating the bricks outweigh the costs of throwing them out. Even if not all the bricks are sold or used in community service projects, it is still better than the bricks ending up in the landfill. ArcelorMittal will benefit in both the eyes of the consumer and monetarily.

VII. Conclusion

Our research and testing proved that utilizing the bricks for landscaping, donations, and profit would be the most suitable option for ArcelorMittal. The prototyping sections demonstrated that the public felt a need for our product and would respond well if given the option. Therefore, our plan seemed like a good solution for the problem at hand.

However, with one week left to complete our project, we finally were able to see a refractory brick. Unfortunately, the brick turned out to not be aesthetically pleasing and is pictured below in figure 11. Even worse, everybody must wash their hands after handling the brick. This kind of material is not something that should be used to build patios, fireplaces, and especially grills in both domestic and public places. This new information brought us to the realization that our plan would actually not work. If given more time we would return to the brainstorming stage and pick a new plan to execute. Unfortunately, we were not given this time and were force to continue with this plan, even though we now realize it is not plausible or in the best interests of the company to pursue.

Figure 11. An actual image of the refractory brick after use.

VIII. Lessons Learned

Throughout this project, we explored the design process and the high level of decision making necessary to go forward with a design plan. We learned how to decide on an idea and develop it further. We learned how to request feedback from a larger audience to change/improve our designs based on responses. We were forced to use this method to acquire data on our prototypes, since more traditional ways of acquiring data were out of the question given our project. With this information we could improve our prototype into a better design. A large part

of this project was research since we were not given much information about the bricks themselves. We had to research the uses, life span, what they were made of, and much more about the bricks before we could continue with the project. Another thing we learned was how to work in a larger group, we had five people this time instead of four. At times there was too much work, but there were also times where there wasn't enough work to keep five people busy for two hours. All together we collectively learned many things through this project that will help us all with future design projects.

VIII. Works Cited

ArcelorMittal. *Edesign 100 Spring 15*. N.p.: ArcelorMittal, n.d. Web. 22 Apr. 2015. <http://sedtapp.psu.edu/design/design_projects/edsgn100/sp15/ArcelorMittal_kickoff.pdf>.

"ArcelorMittal (MT)." *Net Income for*. N.p., n.d. Web. 26 Apr. 2015. <http://www.wikinvest.com/stock/ArcelorMittal_(MT)/Data/Net_Income>.

"Concrete Blocks & Bricks ." *Concrete Blocks & Bricks*. N.p., n.d. Web. 26 Apr. 2015. <http://www.homedepot.com/b/Building-Materials-Concrete-Cement-Masonry-Concrete-Blocks-Bricks/N-5yc1vZboge>.

"Homewyse Calculator: Cost to Install Brick Paver Patio." *Homewyse*. N.p., n.d. Web. 26 Apr. 2015. <http://www.homewyse.com/services/cost_to_install_brick_paver_patio.html>.

"How Much Should a Landscape Company Owner Make? | Green Industry Pros." *Green Industry Pros*. N.p., n.d. Web. 26 Apr. 2015.

"How Much Should Companies Budget for Marketing? - FrogDog." *FrogDog How Much Should Companies Budget for Marketing Comments*. N.p., 01 Feb. 2011. Web. 26 Apr. 2015. <http://frog-dog.com/how-much-should-companies-budget-for-marketing/>.

"Independent Statistics and Analysis." *Gasoline and Diesel Fuel Update*. EIA, n.d. Web. 26 Apr. 2015.

NEW YORK (CNNMoney) -- During Tough Economic times with High Unemployment. "Tons of Trucking Jobs ... That Nobody Wants." *CNNMoney*. Cable News Network, n.d. Web. 26 Apr. 2015.