

ArcelorMittal Project

The Tim Allens

Engineering Design 100

Section 020



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Abstract

The purpose of this project is to develop a means by which the company ArcelorMittal can reduce their waste and environmental footprint. Our instructions are to find a way to recycle their used products in a sustainable and environmentally safe manner. ArcelorMittal listed several products that needed to be dealt with, including: wood pallets, metal drums, plastic totes, and refractory bricks.

Introduction

In a large-scale company such as ArcelorMittal, there is often a large amount of waste product that accumulates due to the production and shipping of goods. ArcelorMittal's notable waste products include: wood pallets, plastic totes, metal drums, and refractory brick. In order to maximize the efficiency of the company, there is a need to minimize waste. Ideally, the solution to minimizing the waste would be through a sustainable, effective process by which the company could put into action with as little hassle as possible.

Mission Statement

For this ArcelorMittal project, our goal was to find a solution for the company's waste materials that would mutually benefit the company and the environment. We have developed an innovative solution that will do just this. Our idea allows the company to reduce their environmental footprint and increase their sustainability. At the same time, this investment will

over time save ArcelorMittal a significant amount of money, and they will actually benefit from a financial gain from the implementation of our idea.

Customer Needs Analysis

In developing a solution to ArcelorMittal's problem of having excess wood pallets, metal drums, refractory bricks, and plastic totes, there were some requirements that ArcelorMittal expressed. ArcelorMittal wanted our idea to: reuse or recycle their waste material, reduce their waste footprint, look good in the public eye, and be feasible.

In order to create a solution that was desirable for ArcelorMittal, we explored possible ideas that incorporated each of the different waste items. Some of the ideas were not reasonable, and some of the ideas were not as good as others. We ended up concluding that our ideas that most effectively addressed ArcelorMittal's needs, involved wood pallets and plastic totes. We have found a process and system that will convert these pallets and totes into bio-diesel fuel that ArcelorMittal can make on-site, and use in their delivery trucks and locomotives.

External Research

One of the first steps was to brainstorm solutions to the problem no matter how impractical they were. In order to find the best solution, the idea had to fit all of the customer needs and live up to the expectations. We researched what to do with all of the products and found several ideas that ranged from creating biodiesel fuel to selling bricks to restaurants to make brick ovens. As we dove further into the researching and brainstorming process, we found that only a few of our ideas were really practical.

One of the earliest and most simple of our composed propositions consisted of just selling the wood pallets to companies who specifically look to buy them. This idea seemed remarkably easy to take to action, as all that would need to take place for this to happen would be the formation of an agreement between ArcelorMittal and the company that would be picking up the pallets. While this idea seemed like a quick and painless solution, it would require active involvement and contact between the two companies, which could cause unwanted issues and complications. ArcelorMittal is a huge company, and these local, somewhat small businesses that ArcelorMittal would be selling to may not be able to handle all of the pallets coming their way. This could cause a constant hunt by ArcelorMittal for new companies to sell to, and would only guarantee a temporary fix to their problem.

Other simple ideas that we came up with included the chipping of wood pallets into wood chips and selling them for the use of schools and parks for playgrounds. Like the idea of simply selling the pallets, this idea would only provide a temporary solution to the problem, and there is no guarantee that this would actually work out. In addressing the customer needs, this solution would, however, potentially make the company look better in the public eye- a company finds an effective solution to recycle their waste products that provides a place for children to play. It also would reduce their growing stock of wood pallets. Overall, this idea was not good enough to suggest to ArcelorMittal, as it was not definite or dependable as a permanent solution. With this idea, however, we did discover that the idea of chipping the wood was on the right track to where we needed to be.

Finally, we found an idea where we could reduce ArcelorMittal's waste and environmental footprint, increase the company's efficiency and sustainability, and create a new

source of a long-term financial gain for the company. The system we found is the AlphaKat KDV 1000 System. The KDV 1000 is a system that can turn chipped wood pallets and plastic totes into a biodiesel fuel. The cost that it would take to create the biodiesel fuel is significantly less than the price tag for buying the fuel off of the market. By implementing a system that creates fuel from the company's waste products, ArcelorMittal would essentially be taking care of all of their needs with one easy process.

By turning the plastic totes and wood pallets into fuel that ArcelorMittal can use to fill its trucks and other delivery vehicles, the company would no longer have to worry about what to do with the totes and pallets. They would never go to waste, or be sent to a dump where they would negatively impact the environment. The creation of valuable fuel would eliminate significant costs from ArcelorMittal's budget. The KDV 1000 system does have a steep price tag, but the production from the machine would pay for itself within the near future. It was clear to us that because of all of these upsides to the KDV 1000 system, this was the idea to pursue.

Benchmarking

While looking around for ways to solve ArcelorMittal's solution, we looked into other companies that have to deal with the same problem. We noticed that companies with similar problems were selling off their waste (LeBlanc). This means that these companies had to deal with other external companies. This is just a hassle and takes a lot of effort between the two companies. This is why we mainly wanted to think of a solution that involved ArcelorMittal internally. This allows the company to invest most of their time on what they do best, which is their steel industry. The only thing the company would have to do is take a small amount of time

to recycle the waste. Another benefit to solving the problem internally is that what they can use the recycled waste to their advantage and benefit their company positively. This alone is why we thought that solving the solution internally would be so much better for the ArcelorMittal. Also because the company is so big and we did not want to branch them out into something else other than what they are known for.

Concept Generation

	Selling Wood Chips	Selling Pallets to Companies	KDV System	Selling Drums	Brick Ovens
Practicality	4	4	4	2	2
Efficiency	3	3	5	3	2
Innovative	2	1	5	1	3
Sustainable	4	3	5	4	4
Long Term Cost Friendly	4	3	5	3	3
Total	17	14	24	13	14

In finding a solution to ArcelorMittal's problem, we generated several ideas that could potentially solve the problem. Once we composed a list of numerous different ideas of what we could do to help ArcelorMittal, we rated these ideas based on important criteria. The criteria we determined that would be important in implementing an idea include: practicality, efficiency, innovation, sustainability, and whether or not the idea was a good long term financial investment. Based on the rankings, we concluded that the KDV system was the best option to pursue for our design project. It proved to be the most practical, efficient, innovative, and sustainable choice for our project. While the upfront cost of implementing our idea is not cheap,

it will prove to be a wise long term investment, as the money spent on the investment would be returned within a short period of time as a result of the machine's production.

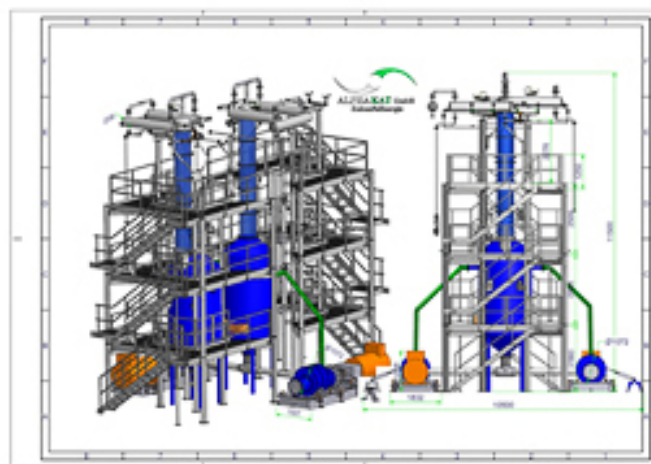
Concept Selection

For the final concept selection, we decided to use the KDV 1000 system. This system developed by the German company Alphakat uses a mix of 25% biomass and 75% polyethylene to create a high quality bio-diesel. The diesel has a high hydrocarbon content of 70-80% making it very efficient for use in vehicles. In addition, engines do not need to be modified to use this fuel.

The KDV 1000 system is a remarkably sustainable option for ArcelorMittal to choose. It is a closed circuit system, meaning there are no adverse environmental effects. Also, it can be set up off the grid, requiring only a generator for initial power, then using a small amount of the diesel it produces to power itself. It does not need any water for production, but produces grey water which can be used in steel production (Saleh-Topitz).

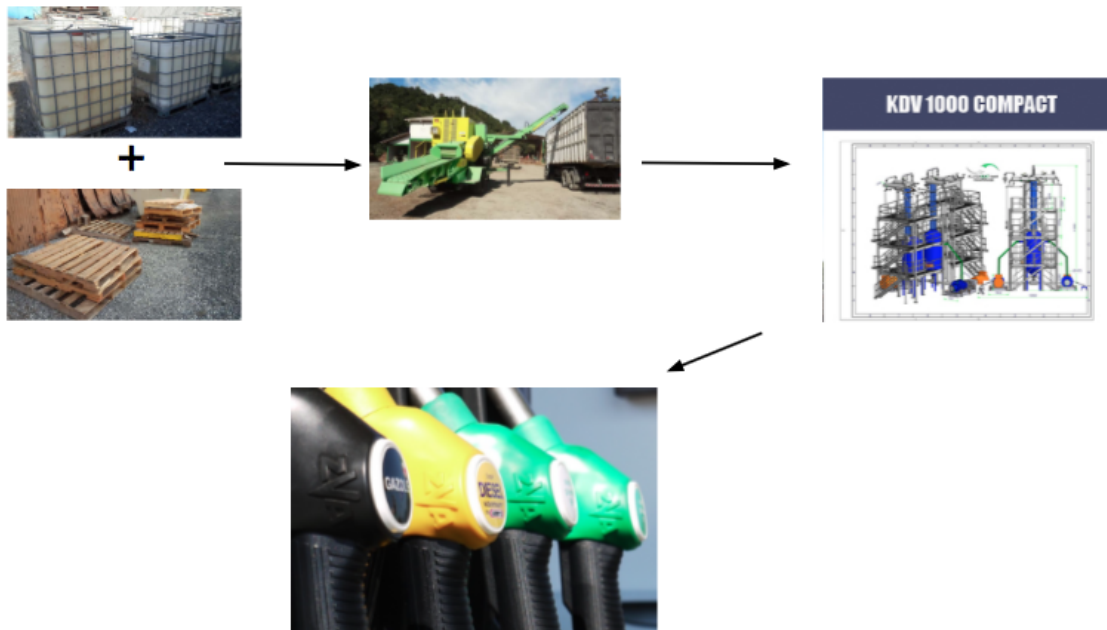


KDV 1000 COMPACT



(Pictured above is the compact version of the KDV 1000 system)

Embodiment Design and Final Design Description:



The flowchart depicted above describes our final plan for ArcelorMittal. The first part of the diagram addresses the source of our plan- the plastic totes and the wood pallets. With our process, these will be efficiently and effectively put to another use. In order to convert the materials into the form that is necessary to go through the KDV system, we will use the Lippel Wood Chipper. This machine is capable of handling both the plastic and wood materials what would be entering it, and it also takes care of the nails that are in the wood pallets. After these materials have been broken down into small enough pieces, they can be put into the KDV system for the conversion to biodiesel fuel. After the processing of the materials and conversion to biodiesel fuel, it is up to the company to decide where they would like to use the diesel fuel- in

their trucks, machines, or other delivery means. This process effectively removes the buildup of waste from pallets and plastic totes, and provides a significant source of cheap, high-quality fuel that can be used by the company. With the implementation of the KDV system, the company overall will become more internally sustainable, more efficient, and will leave less of an ecological footprint.

Cost Analysis:

To make sure that our solution to the problem presented by ArcelorMittal is beneficial to the company, we must determine that our plan is not only sustainable, but also has a positive longer term financial impact. Not only will the company not lose money by implementing our plan to reduce the waste products in the company, but the company will actually make a substantial financial gain from the implementation of this process.

The upfront cost of purchasing the KDV system is \$14,175,000. Along with this cost, there are operating and upkeep costs that are packaged with the use of this machine. However, even after all yearly costs and taxes, the system will produce enough biodiesel that would be the equivalent in over \$4.7 million in the first year. The company could sell the fuel for this money, or it could use the fuel for itself, since it would need it anyway. The money that the company would get from selling it would be equal to the amount of money they would save by using it for themselves. The machine will produce an increasing worth of fuel in each following year, leaving the company with a total income of \$14,813,849 after the first three years, which would already have produced over \$600,000 in profit from purchasing the machine. The turnaround

time to get back even on the investment of the machine is within three years, and in each of the following years, the company would only continue to benefit more from this investment.

The savings produced by the company will be about 25 euro/cents per liter which is the equivalent of \$1.01 per gallon of diesel gas. These savings are based on the fact that the KDV system produces \$2.07 per gallon of diesel gas while the average market price is approximately \$3.08 per gallon of diesel (EIA). With the price of diesel gas reduced for the company for their everyday tasks of running their machines, the company can save a lot of money while at the same time being environmentally friendly.

An example of the cost analysis savings can be shown through two examples from either the trucks or the trains that the company uses to transport materials. For the first example, the company uses 100 trucks to transport steel each truck using 40 gallons of diesel per day. Since the company saves \$2.07 of diesel per gallon, then the company based on these numbers can save \$8,280 per day. Another example of the cost analysis could be the use of the train they use to transport steel. If the average train of 436 ton-miles/gallon the company uses can move 500 miles/gallon per ton of cargo, this means that the average train can move 3,000 tons of materials. With these numbers the average train can use approximately 3,200 gallons of diesel which means that the company can save \$6,624 on diesel gas per train (Fuel Efficiency). Based on these facts of the cost analysis, this proves that our idea to reduce ArcelorMittal's waste products not only does that, but is sustainable and economically beneficial to the company. Depending on how much diesel the company needs, is dependent on what size KDV system will be the most efficient in order to save money and produce the right amount of diesel.

Implementation Guidelines

In order for ArcelorMittal to put this plan to action, there are a few steps to address in how to go about it. First, ArcelorMittal will have to discuss with Alphakat about the logistics of getting the machine to ArcelorMittal's plant. The same process goes for the acquiring of the Lippel Chipping System. Once this part has taken place, ArcelorMittal will need to find a place to put these systems at their location.

With the addition of these new systems, ArcelorMittal will have to hire people to operate these machines. Alphakat projects that in order to run the KDV 1000 system, the company will need to invest \$860,000 in labor costs. Lippel does not provide estimates on labor costs for operating their machines, but it can be projected that the cost would be a fair amount less than the KDV system, due to the system's lack of complexity.

It is worth re-addressing that both of these systems require frequent upkeep in order to keep them running efficiently, so that is also a point of emphasis for ArcelorMittal to focus on.

If these guidelines and points are followed, ArcelorMittal will find themselves in a position of financial gain and waste reduction in no time.

Conclusion

The KDV system is very practical for several reasons. Firstly, it is exceptionally sustainable. Also, running a KDV system has little to no negative effects on the environment. Second, it produces a high quality bio-diesel. The diesel has a remarkably high hydrocarbon content and does not require engine alterations to be used. Lastly, in the near future, the company will be saving a significant amount of money. An investment of \$14 million today

would result in a self-sustaining fuel source for a large amount of ArcelorMittal's diesel needs at their Steelton plant.

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