PENNSTATE

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The Pennsylvania State University
University Park Campus

SUSTAINABILITY PROPOSAL
Aluminum: Sustainable Solutions

EDSGN 100
Section 000#

ALCOA

Design Team 5
Jaxo United
Fall 2013

Submitted to:
Professor Berezniak

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Sustainable STATE

ACKNOWLEDGMENTS

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TABLE OF CONTENTS

SECTION 1. EXECUTIVE SUMMARY

SECTION 2. INTRODUCTION

2.1 LOCATION
2.2 CAMPUS SETTING
2.3 WHAT IS SUSTAINABILITY
2.4 BENEFITS OF ALUMINUM
2.5 SUSTAINABILITY OF ALUMINUM
2.6 CURRENT PRACTICES
2.7 GUIDING PRINCIPLES
2.8 STAKEHOLDER ENGAGEMENT

SECTION 3. BACKGROUND

3.1 SPONSOR BACKGROUND
3.2 PROJECT OBJECTIVES
3.3 PROJECT BACKGROUND
3.4 SCOPE OF THE PROPOSAL

SECTION 4. QUALIFICATIONS

4.1 CREDENTIALS
4.2 DESIGN TEAM MEMBERS

SECTION 5. METHODOLOGY

5.1 GOALS
5.2 METHODS
5.3 IMPROVEMENTS
5.4 IMPACT
5.5 ESTIMATED COSTS
5.6 MODEL
5.7 IMPLEMENTATION
5.8 SCHEDULE

SECTION 6. DISCUSSION

SECTION 7. SUMMARY

SECTION 1 EXECUTIVE SUMMARY

The main goal of the project is to have a more sustainable use of bottles and cartons for the Penn State Creamery's products. This goal will be achieved through the creation and usage of Aluminum bottles and cartons instead of plastic containers. Aluminum containers present a source that can be reused for the same function many times and thus cuts down on waste.

SECTION 2 INTRODUCTION

2.1 LOCATION.
The Pennsylvania State University
210 Old Main, University Park, Pennsylvania 16802

The Pennsylvania State University is located in Centre County Pennsylvania. It is the main campus of the Pennsylvania University system and is approximately 8,556 acres.

2.2 CAMPUS SETTING.
Penn state is located in an urban area. It is a college town where the surrounding area dedicates a lot of time and effort towards the University. There is rarely a dull moment in "Happy Valley" with 950 clubs, the largest student-run philanthropy in the world, dedicated football fans, and a large Greek system. The campus is located next to a small bustling town and surrounded by mountains.

2.3 WHAT IS SUSTAINABILITY. Sustainability according to the United States Environmental Protection Agency is as follows: Sustainability is based on the survival of humans and our interaction with the natural environment. Being sustainable allows humans and nature to cooperate smoothly, ensuring economic well being for the present and the future. http://www.epa.gov/sustainability/basicinfo.htm

2.4 BENEFITS OF ALUMINUM. Through the use of aluminum the lives of people and the society in which they live in has been sufficiently changed for the better. From using aluminum society can decreases the amount of green house gasses released into the environment and be efficient with regards to energy usage. Aluminum has unique physical properties that further enhance its sustainability such as it's strength, durability, flexibility, impermeability, low weight, corrosion resistance, and recyclability. Aluminum is light; with a density that is one-third that of steel. Making aluminum excellent for being used in large sum of products, it is resistant to weather, common atmospheric gases, and a variety of liquids. There is no proof of aluminum having a negative impact on the human body, which means that it is able to be in contact with foodstuffs.

2.5 SUSTAINABILITY OF ALUMINUM. Aluminum has the profit of being recycled repeatedly without any loss in value. As stated by Alcoa, "Recycling aluminum only uses 5% of the energy required to make new aluminum ingot. In addition, recycled aluminum creates 95% less greenhouse gas emissions than new aluminum." Arising from the stages of aluminum's life from cradle-to- grave are environmental impacts. Starting from when resource extraction takes place, this step is called bauxite mining and consists of preparation of the mining area; bauxite mining, crushing, ore transport, and rehabilitation. This impacts the environment by clearing the area for mining and possibly harming the existing habitats for animals in the area. This also has an impact by creating jobs for laborers. During the production of primary aluminum there are impacts due to the high cost of the process because a lot of electricity is used. There are also the negative impacts of loss of landscape from mining and transporting the bauxite as well as air and noise pollution. The use of aluminum is highly beneficial to society from its ability to be used for transportation, construction, engineering, building, and packaging. A positive impact of recycling aluminum is that there is a lot of saving of raw materials and particularly electrical energy. When talking about the "grave" section of the life cycle of aluminum it is important to recognize that this is not the end of aluminum life sense it is recycled. Having a huge impact on society.

2.6 CURRENT PRACTICES. On the campus of Pennsylvania State University there are practices in place that involve the usage of aluminum, utilizing its physical properties and benefits. The trashcans in the buildings are aluminum; the apple computers about campus are constructed from aluminum. While in the dining halls throughout campus you will see aluminum utensils and kitchenware and also within the dorms, the showerheads are constructed from aluminum. Aluminum is all around campus in buildings and incorporated in campus transportation.

2.7 GUIDING PRINCIPLES. With the project objective being to utilize aluminums properties in order to increase sustainability in the surrounding area, one of our main guiding principles was making sure that our innovative product of making the bottles and cartons in the Creamery out of aluminum is overall more efficient than the product currently in place. When designing the bottles and cartons out of aluminum, one guiding principle is to confirm that our product is aesthetically pleasing. When changing a design that so many individuals are familiar with it is important to make sure that the product will still be desirable. Along the way of creating this product it is important to assure we are meeting the three pillars of sustainability: environmental, social, and economic.

2.8 STAKEHOLDER ENGAGEMENT.

Our product, aluminum beverage cans and beverage cartons, will affect a variety of people. First, the Penn State Creamery will be affected by now being required to use aluminum casings

for milk products instead of plastic containers. Furthermore the user of the containers or Penn State students, and creamery goers will now have the ability to recycle their waste with a more reusable product. Lastly the major beneficiary of the aluminum cans and cartons will be the environment itself, with aluminum cans and cartons, products will be recycled and reused for the same product, waste will be cut down and eco efficiency will go up.

SECTION 3 BACKGROUND

3.1 SPONSOR BACKGROUND. Alcoa (www.alcoa.com) is world's leading producer of primary and fabricated aluminum. It is also the largest miner of bauxite and refine of alumina. Alcoa invented the modern-day aluminum industry 125 years ago, and its innovation has been behind major milestones in these markets:

- Aerospace
- Automotive
- Packaging
- Building and Construction
- Commercial Transportation
- Consumer Electronics

3.2 PROJECT OBJECTIVES. Finding opportunities across the campus of Penn State University to take advantage of aluminum for the purpose of increasing the efficiency or sustainability of products and product systems.

3.3 PROJECT BACKGROUND. Aluminum, with its lightweight and strong property, has played significant roles in historical events such as Wright flyer and Boeing 787 Dreamliner. Today, the efficiency of energy usage and finding solutions that are increasingly sustainable are really important. That being said, aluminum is extremely important since its strength and lightweight allow aircraft and ground vehicles to save fuel while providing us with the performance we need. It is also highly recyclable; over 70% of the aluminum ever produced remains in use today.

3.4 SCOPE OF THE PROPOSAL. The purpose of this project is to introduce the great sustainability and economic benefits of using aluminum. The Penn State Creamery's usage of plastic bottles and cartons can be economically and environmentally improved by replacing them with aluminum. Through calculating the cost of aluminum and plastic usage in the long run and comparing them, we are able to prove the fact aluminum is more efficient.

SECTION 4 QUALIFICATIONS

4.1 CREDENTIALS.

Olivia Poppel

Education:
The Pennsylvania State University, University Park PA
The Pennsylvania State College of Engineering
Relevant Courses:
Engineering Design and Development- High School Course
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SECTION 5 METHODOLOGY

5.1 GOALS. The goal of this project is to introduce the efficiency of aluminum to campus by replacing plastic bottles cartons with aluminum bottles and cartons in Penn State's Berkey Creamery. This will induce sustainability and the ability for Penn State to be a more energy efficient campus.

5.2 METHODS. We came up with our product through recognizing our daily use of plastic on campus from the Berkey Creamery bottles and cartons. We concurred that the use of reusable aluminum cans and cartons would cut down on wasted plastic. Thus coming up with aluminum creamery cartons and cans was undoubtedly best choice. It was necessary to look at details when comparing aluminum and plastic such as how much material is needed to make our products, how extensive the process of recycling is for aluminum and for plastic, the pros and cons of aluminum to the consumer. We calculated the overall cost of bought aluminum and the cost of recycling aluminum products. Then we compared this total cost to that of plastic to get comparison data of efficiency for plastic and aluminum.

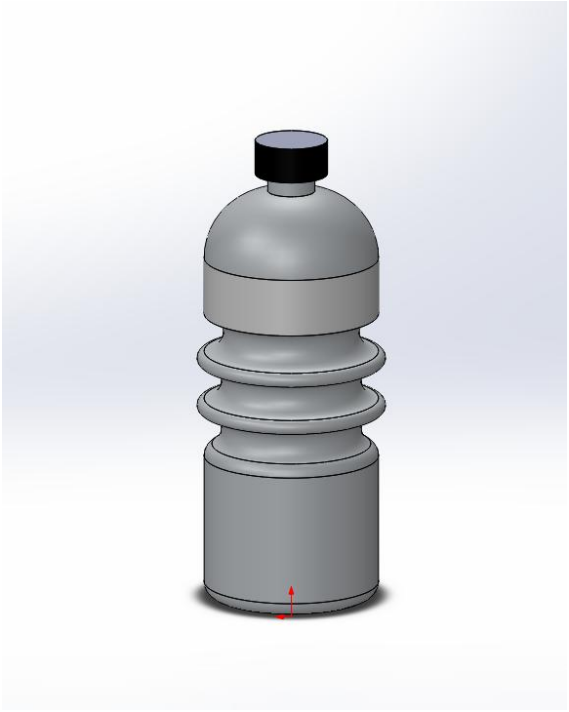
5.3 IMPROVEMENTS. Using aluminum bottles instead of plastic would cost more since the price of aluminum is slightly higher than that of plastic. However, in long term, the efficiency of aluminum is much beneficial economically and environmentally. Creating aluminum can from recycled materials only requires 5% energy and the quality of product stays almost unchanged, while recycling plastic needs more energy and many plastics become different types of product due to chemical alterations. Plastic bottles take centuries to decompose and if they are incinerated, toxic byproducts, such as chlorine gas and ash containing heavy metals, are released into the atmosphere.

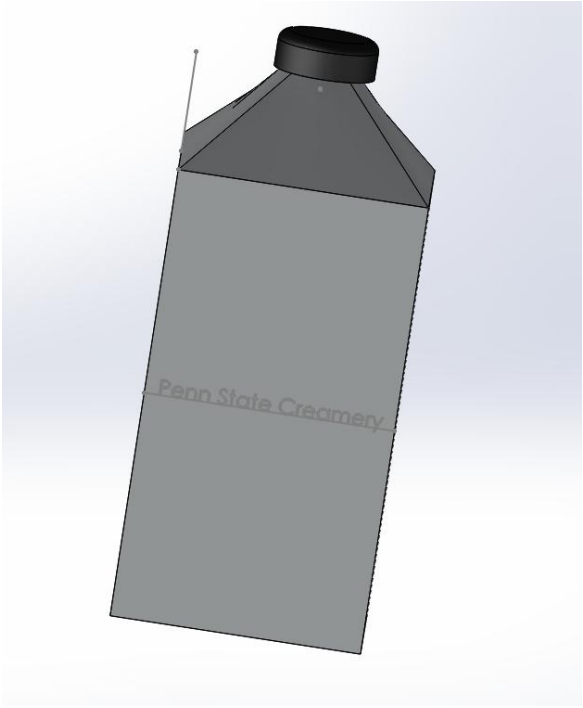
5.4 IMPACT. Our proposal of constructing the Penn State's Berkey Creamery bottles out of aluminum will impact the campus as well as the surrounding region if implemented. The campus will be using a lot less plastic and with the bottles and cartons being made out of aluminum will increase reusability. Aluminum is infinitely recyclable and using aluminum will create a more sustainable environment both on campus and around campus because the majority of residents in the State College area are frequent customers for the Berkey Creamery. It will be of interest to our team as well as the Creamery how consumers react to not being able to see what they are drinking. This will most likely affect consumers because we are already so accustomed to being able to see what exactly we are putting into our bodies when it comes to beverages like milk, orange juice, etc.

5.5 ESTIMATED COSTS. The cost of aluminum per bottle is about $0.35 and the cost of plastic per bottle is about $.06. The cost of aluminum is higher than that of plastic, but the long-

term usage of aluminum is cheaper than plastics. Recycling aluminum requires 95% less energy than creating a new bottle or carton from a scratch, and the quality of recycled aluminum is consistent with the original one, unlike plastic. During the process of recycling Plastics, some kinds of plastics become different types of plastics due to the chemical reaction. Therefore the efficiency of recycling aluminum is far better than recycling plastics. Installing this product could be done at night during the closed hours of the creamery, ensuring there is no loss of income for the creamery while our bottles and cartons are being inserted into the refrigerators. The manufacture of these bottles and cartons will be done through the use of mass production. A machine will be programmed to know the detailed shape of the bottle or carton and using this knowledge will create and process our product. The maintenance of our bottles and cartons will consist of recycling and ensuring that these recycled items are reused for varied purposes. When looking at the long-term cost benefits of our proposal, the Creamery will possibly have an increase in profits because of product. The packaging of aluminum is less than that of plastic, taking less from the Creamery's income.

5.6 MODEL. Presented is an image of the physical prototype of our aluminum Creamery bottle and carton. The bottle and carton will be constructed primarily out of aluminum with a layer of insulation inside that will protect liquids from outside temperatures. The cap will be constructed out of plastic. Being insulated will help keep the specific beverage cooler longer. The bottle will hold 1 cup of the specified beverage and the carton will hold 1 gallon of liquid.





5.7 IMPLEMENTATION. Our proposal of transferring the plastic Penn State Berkey Creamery bottles to aluminum will take place in the spring. This is mainly for the reason that the small affect of the cold aluminum on consumers will not be of worry. So the Berkey Creamery products that are already in stock in the current plastic containers are not put waste we will wait for these current items to sell out and restock on aluminum containers as necessary from there on out.

5.8 SCHEDULE. First in implementing our proposal it would be necessary to meet with a group of the Berkey Creamery executives and discuss our product. A lot of questions will be asked here as to why the implementation is taking place. Then a product design review will take place. This will consist of reviewing what has been done in the past and how the new bottles and cartons will be used, by who, and when. The market acceptance of our proposal will be thoroughly reviewed. Establish a Financial Forecasting Capability that Provides a New Product Control Chart. After much discussion and before the physical implantation of the product there will be advertising of the new bottles and cartons so that it is not an unforeseen change. As well as advertising to inform the public of this proposal, a mass email will be sent out to those on campus, affiliated with campus, and the residents in the area. This will all be done in the summer before school starts in the so that the proposal will be eased into the minds of consumers before then taken into action in the spring of the same year.

SECTION 6 DISCUSSION

Our aluminum bottle will cut down on plastic on the Penn State campus because the creamery is a major stop for students, professors, alumni, and touring high school students, and many of these people buy the Creamery's teas and beverages on a daily basis. Also the creamery isn't the only place on campus that sells their beverages, the café's located all around campus also sell Creamery beverages. If you check every trashcan on campus it is likely that you'll find a plastic Creamery bottle. Let's face it not everybody recycles these bottles and the plastic bottles at the creamery are very thick. The plastic bottles take a lot of processing in order to be created. With the aluminum bottle that we created we could make it easier for the university to recycle. This bottle design could be used by all kinds of bottling companies around the world due to our designs for all different sizes of bottles. People may not be in favor of having the aluminum bottles in the cold weather of Pennsylvania making their hands uncomfortable. The aluminum would be colder than the plastic would be, but we plan on making these bottles with insulation so there should be no problem with our proposal in that sense. Even if people don't necessarily approve of the aluminum bottles, it shouldn't affect the sales for the creamery. Everybody loves the teas, juices, and milks from the creamery and they will just keep coming back for more. Another bonus with our proposal is the cost of the beverages might go down depending on the creamery due to the cheaper packaging material.

SECTION 7 SUMMARY

The aluminum bottles will drop the amount of plastic on the Penn State campus. This will make the university a healthier and sustainable place. A strength of our product is that the bottles and cartons are constructed of aluminum, a more recyclable material than plastic. A product weakness would be that in University Park during the seasons of fall and winter the properties of aluminum might lead to dissatisfaction for consumers. Canceling out this disadvantage is the fact that our design includes a layer of insulation so that the consumer will not be affected by aluminum being cold to the touch in a cold environment. Another advantage of our product is that we have all different sizes of bottles, unlike other aluminum bottling companies. A disadvantage is that as innovators we do not know exactly how the implementation of our product will affect the overall income for the Creamery. This could cause problems if there is a negative reaction to the aluminum bottles and cartons since the creamery is a major flow of commerce for the university. We do not expect a negative reaction from our proposal though; the insertion of aluminum bottles and cartons in the famous Penn State Berkey Creamery will increase the sustainability of campus and enhance the lives of those in the area.