Understanding the Needs, Requirements, and Definition of the Problem

Research and Product Development

- Naturally occurring element, the most abundant metal
- Its abundance and low density made it lucrative for companies to use as a metal
- Lightweight, stores energy, doesn’t corrode, so builders thought it to be a useful building material

Marketing

- Companies need aluminum for the production of their products
- People do not recreationally use aluminum
  - Besides aluminum water bottles, which represents a minimal percentage of aluminum use
- Therefore, there is no need to mass market aluminum, the demand for aluminum is constantly growing since companies are constantly expanding and creating more products
- Markets itself
- There are several large companies for aluminum, creating an oligopoly market for aluminum
- Aluminum makers advertise its benefits
  - Benefits include: strong, lightweight, recyclable, non-corrosive

Manufacturing

- Manufactured globally
- Most often extracted from a clay-like compound named bauxite
- Two phases of manufacturing aluminum
  - Bayer process
    - Refines bauxite to aluminum oxide
  - Hall-Heroult process
    - Smelt the aluminum oxide to produce pure aluminum

Packaging

- Not packaged much
- Only slight wrappings to prevent scratches on the aluminum

Sales, Distribution, and Transportation

- Sold in bulk to companies that use aluminum as a means of packaging their product
  - i.e., soda companies
- Used as a raw material for companies that use aluminum as a component of their product
  - i.e., mp3 players, computers, construction companies
- Distribution
  - Distributed in bulk or as a raw material
  - Brought from the aluminum manufacturer to the location it needs to be by boat, train, and/or tractor trailer
  - Distributed in many different forms such as sheets, piping, angle, flat bar, etc.
- Usually distributed from wholesale distributors to smaller companies that use aluminum for their product

- **Transportation**
  - Brought overseas by boat
  - Domestically by train/tractor trailer

**Consumer Use**

- Not generally used by individual consumers, but rather by companies to produce their good that individual consumers will use
- Present in everyday situations for individuals, such as building construction, liquid containers, and transportation
- Its uses are growing as more applications for aluminum are found
  - More efficient, lightweight materials are being made, and naturally, they use aluminum

**Final Disposition**

- Can be recycled by re-melting the aluminum
  - Far less expensive and uses less energy than initially producing aluminum
- Approx. 31% of aluminum in US is from aluminum scrap
- Most of the aluminum is recycled
  - 98% in Brazil, 85% in Japan
- If not recycled, aluminum will not decompose quickly
  - For example, 80-100 years for an aluminum soda can to decompose

At Penn State University and other campuses throughout the world aluminum is transforming the construction of buildings. Aluminum is being utilized in new construction projects to give these buildings a modern elegant appearance and to create energy efficient structure. The unique properties of aluminum are allowing us to reduce our use of energy and to create a more sustainable world. Currently, buildings represent 40% of the world’s energy demand however, with the introduction of aluminum in structures, we can greatly reduce our demand.

Aluminum has unique properties which allow it to be beneficial to building construction. It is a recyclable material, and as all building go up, we know with time they will be replaced as new technologies are created. Aluminum has a 100% recycling rate, meaning that the aluminum used in buildings will be able to be utilized elsewhere when the time comes. Aluminum also has a high strength to weight ratio. Due to its strength we are able replace other metals and materials with this completely recyclable metal, reducing our waste to the environment. It also has resistance to corrosion, meaning that it will never rust always retaining an elegant appearance when reused in projects.

At Penn State, the Lewis Katz law school building has utilized aluminum to save energy. This building was uniquely designed to have windows covering every side of the building. The widows are supported by aluminum mullions which act as thermal barriers retaining heat within the system. Windows allow sunlight to enter the building while the aluminum retains his heat, becoming a benefit when outside temperatures are cold reducing the amount of energy necessary to heat the building. However, during the summer time, this can act negatively, making it more difficult for the building to remain room temperature. While the main framing of the structure was made of steel, part of the framing was made of curved aluminum. While other metals are unable to be easily bended into the waned shape, aluminum is ductile, and using this metal the architect’s wants were satisfied. Due to the
light weight property of aluminum, it is able to be installed rapidly, reducing the time of construction and in turn reducing cost.

If we replace old buildings at Penn State, utilize aluminum, our campus will have a greater efficiency. We use aluminum as siding, roofing, gutters and as window framing we can create a modern elegant appearance on campus while striving for an energy efficient campus.

http://www.heintges.com/project.php?id=penn-state-school-law
http://www.aec.org/assets/pdfs/AEC_Daily_Course.pdf