It is essential for the material used in the production of automobiles to fulfill a list of criteria before it is approved and implemented. Certain criteria originate from the environmental and safety concerns which result in the regulation and legislation requirements and some criteria are simply the requirements of customers (Ghassemieh). With the growing concern of the environment, there is a significant investment in implementing in lightweight materials to improve the fuel efficiency of an automobile and to also reduce the greenhouse gas. In addition to it, recycling and life cycle considerations are also extremely important criteria for the automobile material. This can help the industries to be able to reuse the materials and to protect the resources (Ghassemieh). The life cycle analysis of materials helps to obtain a thorough overview of the materials such as energy consumption at all stages. Safety, crashworthiness and the cost of material such as the cost of raw material, manufacturing value added and the cost to design are all under the criteria for a suitable automobile material (Ghassemieh).

Aluminum is an excellent candidate as a lightweight material that is capable of reducing the fuel efficiency significantly in which cannot be done with the use of steel. Currently, the use of aluminum in automobiles is facing two major challenges: the cost of aluminum is twice as high as steel and its manufacturing difficulties under mass production (Aluminum Alloys: Promising Materials in the Automotive Industry, 2002). However, the efficiency of a design should not be evaluated simply in terms of the cost.

Aluminum offers the ultimate automobile engineering solution that its density is three times lower than steel, it obtains a high corrosion resistance, suitable strength for dent resistance, and possessing adequate formability (Automobile Bodies: Can Aluminum Be an Economical Alternative to Steel?, 2001). A reduction in mass can be attained by substituting aluminum alloys instead of steel. At 120 kg per car for 10 million cars with the mean annual haulage of 15 thousand km can save 982 million liters of fuel and reduce CO2 emission in the atmosphere by 2.3 million ton (Aluminum Alloys: Promising Materials in the Automotive Industry, 2002). By increasing the fuel efficiency, the petroleum energy can be saved; this can potentially offset the additional energy needed to manufacture aluminum compared to steel (Life-Cycle Energy Savings Potential from Aluminum Intensive Vehicles). Moreover, aluminum fulfills the recycling criteria with a high degree of utilization of 85 to 95%. Although the total energy of production for virgin wrought aluminum is approximately 231 MJ/kg compared to the total energy of production from virgin steel of 65 MJ/kg, the recycled production of aluminum and steel are both at 52 MJ/kg (Aluminum Alloys: Promising Materials in the Automotive Industry, 2002). In addition, the cost of labor and maintenance can be reduced due to aluminum alloys’ high corrosion. As a result of it, the automobile body can preserve for 20 years even after its service life and it under severe climate condition (Aluminum Alloys: Promising Materials in the Automotive Industry, 2002).