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FOR ENGINEERING AND SCIENCE

Sustainability Issues

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Description

An overview of the sustainability issues encountered during the design process of an ultra-lightweight vehicle.

Body

The World Commission on Environment and Development, the Brundtland-commission (WCED, 1987) proposed the following definition of sustainable development:

> Sustainable Development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:
>
> 1. The concept of "needs", in particular the essential needs of the world"s poor, to which overriding priority should be given.
>
> 2. The idea of limitations imposed by the state of technology and social organization on the environment"s ability to meet present and future needs.

When following the Brundtland definition it is not clear what makes a car sustainable - should the car be recyclable, be lightweight, or should it not be built in the first

place in order to be sustainable? Designers within the same design team interpret the term sustainability differently as can be seen in the answers given when asked what sustainability means. Some refer to the closing of the material cycle by recycling, others refer to energy and resource efficiency during production and use, and some focus on the energy consumption during the use phase (90% of the total life cycle energy is used during the use phase) of the car.

These different definitions are not always compatible. Lightweight materials are often difficult to recycle, but the energy consumption of a very light car is very low. European legislation requires that within ten years 95%(1) of the materials in cars should be recyclable. The design team does not want to comply with this percentage; they would rather build a very light "throw-away after use car" than a heavy steel car that can be recycled. Their argument for this choice is that most energy is consumed during use of the car and that mass is a large factor in energy consumption during use. A lightweight car would therefore require much less fuel than normal cars. This would also mean that, other things being equal, the CO2 emissions of lightweight cars would be less than that of normal cars.

- (1)95% of the total mass, so a heavy steel car that can be melted at once when interior, electrical wiring, battery and dangerous chemicals are removed will comply with this legislation. Steel is 100% recyclable. Complying with this legislation when designing a very light car is much harder because the interior, electrical wiring, battery etc will make up much more than 5% of the mass of the car and the relative mass of the easy-to-recycle body panels and cage construction is much lower than in the heavy car.

Notes

Questions and comments about this case can be directed to Missy Cummings, Massachusetts Institute of Technology or Anke van Gorp, Delft University of Technology.

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Resource Type

Case Study / Scenario

Topics

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Sustainability
Public Health and Safety

Discipline(s)

Engineering
Mechanical Engineering