

# STEM ACTIVITY

<Blue-A-Head> Earth and Human Activity

<Orange-B-Head> Science and Engineering Practices

<Orange-B-Head> Designing Solutions

<Green-C-Head> Design to Reduce Waste

As the world's human population soars, so does the problem of solid waste management. By 2025, some warn that people will be producing more than 6 billion kilograms of solid waste every day as compared to the more than 3.5 billion kilograms they produced each day in 2010. Managing all this waste costs hundreds of billions of dollars a year. However, without effective management, solid waste will pollute the environment, sicken people, and contribute greenhouse gases to the atmosphere.

Developed countries, especially the United States, contribute the major share of the daily solid waste produced globally. According to the Environmental Protection Agency (EPA), Americans generated about 707 million kilograms of solid waste every day in 2013. You might be surprised to learn that containers and packaging made up almost 30%, or about 211 million kilograms of that solid waste every day in 2013.

To reduce the amount of packaging heading to landfills, companies must find new ways to package their products. By redesigning their packaging, businesses can reduce the amount of solid waste entering landfills. However, different products need different types of packaging. Therefore, many new packaging options need to be developed.

## Design Solutions

Break down the problem of packaging into a more manageable problem by designing, building, and testing a package for either a food or a product you often purchase. Your packaging needs to be compact, cost effective, and environmentally safe. It should also use less material than it currently does. Do some research. Identify and prioritize the criteria for your design before you settle on a design solution for your packaging. Then, build and test a prototype. Troubleshoot and redesign your prototype before evaluating your solution based on your prioritized criteria and the trade-offs you made to account for the constraints.

When you are satisfied with your prototype, communicate your results. Include a list of sources used to research the design of your packaging, a list of materials with an explanation of why you chose them, a sketch of your design, and a description of how you evaluated your solution based on your criteria and constraints. Also include a model of the impacts of your design solution on the costs of the food or product and on landfills over time.

References:

<http://www.worldbank.org/en/news/feature/2013/10/30/global-waste-on-pace-to-triple>

Standards:

HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.\*

HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.\*

HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.