# **STUDENT GUIDE** EXPLORE LESSON 22



### Part 1: Our Motivation

Record the next steps we will take in the engineering design process.

We know that the next step in the engineering design process is determining the criteria and constrains for a problem. I want to know more about how we start figuring out what those are.

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#### Part 2: Brainstorming Criteria and Constraints

Generate a list of <u>criteria</u> that successful designs should meet. Be sure to consider criteria that will best meet the needs of multiple stakeholders, such as dairy farmers, consumers of dairy products, and the environment.

- Functionality-Product or service should meet/serve a need.
- User-Friendliness-easy for the consumer to use.
- Safety-meets various safety requirements.
- Durability-withstands use.
- Aesthetics-looks good/visually pleasing.
- Accessibility-easy for consumer buy and use.
- Sustainability-sustainable practices are in place for production, use and disposal of product; may also maintain effective use over time.
- Cost-effectiveness- meets budget requirements.
- Innovation-new and fresh idea.
- Adaptability-can be used in various ways.
- Environmental impact reduces a specific environmental impact, such as biodiversity loss or GHG emissions or both.

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Next, brainstorm possible examples of <u>constraints</u> on our solutions. Be sure to consider the needs of multiple stakeholders.

- Time-solutions should be implemented in the next 10 years.
- Budget-solutions should be cost effective.
- Resources-solutions should include resource that can be found/obtained easily.
- Expertise- encourages support from experts.
- Regulations and Standards-meets standards for impacted industries.
- Environmental Factors-greenhouse gas emissions should be reduced.
- User Needs and Expectations-solution still meets the needs of the producers and consumers.
- Existing Infrastructure or Systems-solution considers current infrastructure and systems.
- Ethical and Social Considerations-animals should be treated humanely.



### Part 3: Developing Specific Criteria and Constraints

Classify the criteria and constraints the class generated into the categories below.

Considerations in a proposed solution	Criteria	Constraints
Scientific Needs	Safety-needs to meet food-safety requirements.	Regulations and Standards-meets standards for impacted industries.
Social Needs	User-Friendliness-solution is easy for producer to implement and/or easy for consumer to use.	Social Considerations-animals should be treated humanely. Time-solution being implemented within the next 10 years.
Cultural Needs	Accessibility-the ability for groups of people to access the food products at stores.	How food is processed and packaged for various cultural/religious requirements.
Economic Needs	Cost-effective packaging.	Materials fit within the budget.
Environmental Needs	Environmentally friendly, compostable, recycled products.	Needs to meet temperature and food-safety requirements.

Criteria	Constraints
Student responses will vary.	Student responses will vary.

If your solution was successful according to the criteria you chose, what new tasks would it accomplish? How would you know it was successful?

Environmentally friendly packaging would help reduce waste from the dairy system by reducing the amount of materials used in packaging and reducing the amount of waste that gets thrown away. This redesign of the system can help the dairy system produce dairy products for customers while reducing packaging pollution in the environment. We could measure how much less material is used in new pacakaging compared to old packaging, and we could analyze if the new packaging breaks down in the landfill.