

# GRADE 4 SCIENCE/MAKER: SUSTAINABLE ENERGY BARGE



Submitted by Catherine Walton, 2024, while serving as Science & Makerspace Teacher/Coach at Frankfurt International School

## LEARNING PLAN OVERVIEW

<b>Subject(s)</b>	<ul style="list-style-type: none"> <li>Natural Sciences</li> <li>Design Thinking</li> </ul>
<b>Grade Level (s)</b>	Upper Primary (ages 8-11)
<b>Systems Tool(s)</b>	Sustainability Compass
<b>Purpose of Using Tool</b>	<ul style="list-style-type: none"> <li>Inquiry</li> <li>Critical Thinking</li> </ul>
<b>Summary</b>	In this lesson, students think about the sustainability of importing to Germany by shipping. Students use the Sustainability Compass tool to help them process their thinking and come up with some alternative ideas of energy production to move items across the water. Then students work in the makerspace to build a model of their ideas. Finally, students will draw out a mental model tracing the forms of energy through their system.

## Learning Objectives

In this lesson, students will be able to:

- Use the Sustainability Compass tool to reinforce system thinking and inquire about the sustainability of shipping
- Use the Design Cycle to solve the barge challenge problem
- Use mental models to show energy transfer through the designed barge system

## Material and Settings

### Materials for the whole class:

- Baby pool filled with water
- [Barge Compass Lesson](#)

- [Barge Makerspace Lesson](#)

**Materials per Group of 4 students:**

Various building items such as: (but not limited to...)

- Small wood planks
- Propellers
- Fabric
- Pipe Cleaner
- Craft Sticks
- Wood Balls
- Gears
- Other various wood pieces
- Rubber Bands
- String
- Balloon
- Paper Fasteners (brads)

Tools for Creating:

- Scissors
- Tape (I limit this)
- Wire Cutters
- Saws (if cutting the wood)

## Learning Context

This is one lesson in a Unit of Inquiry about Energy. Up to this lesson, students have been learning about forms of energy (kinetic, potential, sound, light, electric, thermal, and chemical). They have been drawing mental models to explain how systems, focused on each type of energy, work and to show the transfer of one type of energy to another. In this next portion of the unit, students put the energy to use by designing solutions to challenges.

## Purpose of Using the Systems Thinking Tools

This tool is a system tool to get students thinking about sustainability. I liked that the students were thinking about the costs and benefits of shipping to Germany from all over the world. I also liked that in a unit systems, they were using another systems tool.

## Learning Plan Step-by-step Description

### Lesson Plan Using the 5E Science Learning Cycle format

#### This first section is a 45 minute lesson

##### Engage

- Introduction: Ocean Barges
- Slides 1-4 in the [Barge Compass Lesson](#)

##### Explore

1. Use of Compass Tool:
  - a. Slides 5-7 in the [Barge Compass Lesson](#)
2. Review the Sustainability Compass tool ideas. What are the costs and benefits of barges?
3. Pose the question, is there a more sustainable way to deliver goods from across oceans?

#### This second lesson is a 90 minute lesson

##### Explain:

Go over the design challenge. Slides 1-6 in [Barge Makerspace Lesson](#); be sure to review the students' ideas about the cost and benefits of shipping across oceans in barges.

##### Elaborate:

- Slides 7-8 in [Barge Makerspace Lesson](#).
- This is the bulk of the design/creation portion. Students are given 10 minutes to think and design. There should be no building at this point, the focus should be on sharing ideas and coming up with one design.
- After 10 minutes and with teacher approval, students have 40 minutes to build and test (and redesign) their design. The design must travel the length of the swimming pool with the weight attached.

##### Evaluate:

- Slide 9 in [Barge Makerspace Lesson](#).
- Students present their designs to the class and talk about successes and failures.
- After the presentation, students are asked to draw their final design in their journal and document where the energy transfers have taken place.

## REFLECTION

### Plusses

When the Sustainability Compass tool is not used with this lesson, it has no context. The lesson provided is the first iteration of the lesson. In the second, we did not use the Sustainability

Compass tool because of time constraints. The lesson without the tool felt disjointed and was not grounded for the students.

Using the Sustainability Compass tool helped the teachers prepare the students for the maker lesson in homeroom, got them thinking about alternate forms of energy, and enabled them to make connections between their own lives and theory we are learning at school. In other words, it was not just a "fun" lesson, the Sustainability Compass tool gave it meaning beyond the school building.

### Areas for Improvement

As mentioned above, this was the first iteration. If this lesson is done again, I would bring back the Sustainability Compass tool.

Other areas for improvement would be to make a greater tie-in to the sustainability than just at the beginning. I would have students reflect more about sustainability within their presentation of their devices. Also, I would decrease the amount of weight that students put on their barges; 160g is a little too heavy and less weight would mean more success.

### EVIDENCE

