PRINCIPLE 2: NATURE USES ONLY THE ENERGY IT NEEDS

How can we learn economization from nature?

Erasmus+

AGE RANGE

12–16

DURATION

Preparation:
about 20 min.

Activity:
about 45 min. / 1 lesson

SUBJECT(S)

- Science – *Physics, Biology*
- Design, Engineering and Technology
- Mathematics

KEYWORDS

Biomimicry principles; function; energy

SUMMARY

Nature does not waste energy. How can we notice this in nature? In this module we explore how nature uses energy.

BIOMIMICRY PRINCIPLES

2 – Nature uses only the energy it needs

LEARNING OBJECTIVES

- Students understand the importance of energy within nature.
- Students understand that nature does not create waste.
- Students understand they are an interconnected part of nature.

LEARNING OUTCOMES

- Students investigate forms of energy in nature.
- Students research about energy efficiency in nature.
- Students search examples of energy from different habitats and from their previous experience.

BIOLEARN COMPETENCES

- Students are able to abstract principles of sustainability from the way the natural world functions.
- Students are able to identify functional design in nature, develop greater awareness and appreciation for design excellence in nature, and appreciate how nature works as a system which is elegant and deeply interconnected.
- Students are able to use analogical creativity to innovate, using biological models to inspire solutions to design challenges.
- Students are able to work in groups.
- Students are more motivated in learning STEAM and experience that knowledge of STEAM can be widely used.

SUMMARY OF THE ACTIVITIES

	Activity Name	Short description	Method	Duration	Location
1	Introduction	Presenting the principle 9_principles.ppt	• Teacher presentation • Discussion	10	Indoor
2	Searching for energy forms	Searching for examples of energy usage in nature	• Observation	25	Outdoor, best in sunshine
3	Review	Discussion after the activity	• Discussion	10	Indoor/ outdoor

BACKGROUND FOR TEACHERS

See at Activity 1: Introduction.

For interconnections see *Nine Principles of Biomimicry* module.

LOCATION
Indoor

TOOLS AND MATERIALS

- projector, PC
- 9_principles.ppt; 3rd slide

PREPARATIONS

Arrange classroom for presentation and discussion.

RESOURCES

Benyus, J. M. (2002): Biomimicry – *Innovation inspired by nature.* HarperCollins Publisher, New York, U.S.A.

1| INTRODUCTION

» QUESTION

Present the slide about Principle 2: 9_principles.ppt, slide 3.

Nature takes only what it needs. So why do we not do the same? Our economy is focused on maximizing output and is a big energy consumer. We transport food around the world because that is economically cheaper. Only money seems to count in a lot of decisions, not our energy consumption and the impact this has on the natural world. How can we learn to optimize the performance of goods and services to sip energy rather than gulp it?

Explanation to 9_principles.ppt, 3rd slide:

Animals only take the nutrients they need; plants do not absorb more water than is necessary. The hamster stores as much grain as it needs over the winter; likewise, the squirrel collects sufficient hazelnuts for winter food. And if there are any seeds leftover, they become food for another animal or grows into a new tree.

The cheetah can run very fast, but only for a short distance. If catching the prey means using more energy than it puts into running, it stops running.

Predators only kill sufficient prey to meet their needs, leaving others for future meals. The wolf, for example, cannot eat a whole deer so it buries it to return and consume more later. Most people in society buy much more meat than they can consume. How much meat is stored unnecessarily in freezers? What will happen to it? How much energy and materials were necessary to produce this meat and how much energy needed to store it?

Migratory birds fly in a V-shape which creates an airflow that acts as a buoyancy force for the next bird, thereby maintaining speed and altitude with less effort. The V-shape helps birds save energy.

LOCATION
Outdoor

TOOLS AND MATERIALS

- Student worksheet: W2.1
- Teacher's page: T2.1

PREPARATIONS

This activity can be made anywhere outdoors. The more natural the environment the better.

Cut W2.1 into cards.

RESOURCES

Stier, S. (2014): *Engineering Design Inspired by Nature*. The Center for Learning with Nature, Coralville, U.S.A. https://www.learningwithnature.org/

2| SEARCHING FOR ENERGY FORMS

» DISCOVER

This activity provides students practice using analogical reasoning for bio-inspired engineering outdoors. The activity can use cards with any functions, but in this case we will use cards with energy and energy efficiency attributes (W2.1).

Go outside and form groups of 2–3 students. Give each group a card with an attribute. Their task will be to find an object in nature with the attribute about energy. At the beginning search for objects together, and then allow students to search freely for the attribute(s) on their card(s). Some possible answers can be found in T2.1.

After each group finds an object, they show each other what they have found. Ask them think and talk about energy efficiency in nature.

LOCATION
Indoor / Outdoor

PREPARATIONS

Arrange classroom for discussion.

3| REVIEW

» QUESTION

After the activity above talk with students about the principle:

- What forms of energy did you find in nature? Were they flows or stores of energy?
- What does energy efficiency mean in nature?
- Think about the principle itself; have you noticed any creature wasting energy (besides humans)?

T2.1 SEARCHING FOR ENERGY FORMS

Possible solutions

Generate energy:_____ sun
Power without pollution: _____ leaves
Insulate:_____ wood, fur
Collect sunlight: _____ leaves
Store energy: _____ seeds, fat of animals
Cool down: _____ sand
Withstand wind:_____ trees
Transfer energy: _____ streams, rivers
Warm up: _____ reptilians
Reflect the sunshine: _____ water surface
Slow down vital process (before winter): _____ some mammals
Collect energy (different ways):_____ soil, trees, animals

W2.1 SEARCHING FOR ENERGY FORMS

Cards for exploration

Generate energy	**Power without pollution**	**Insulate**
Collect sunlight	**Store energy**	**Cool down**
Withstand wind	**Transfer energy**	**Warm up**
Reflect the sunshine	**Slow down vital process (before winter)**	**Collect energy (different ways)**