

PRINCIPLE 2: NATURE USES ONLY THE ENERGY IT NEEDS

How can we learn economization from nature?





DURATION

Preparation: about 20 min.

Activity:

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.



about 45 min. / 1 lesson

 Science – Physics, Biology
Design, Engineering and Technology
Mathematics



Biomimicry principles; function; energy



SUMMARY OF THE ACTIVITIES

	Activity Name	Short description	Method	Duration	Location
1	Introduction	Presenting the principle 9_principles.ppt	Teacher presentationDiscussion	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



OUTLINE OF THE MODULE

BACKGROUND FOR TEACHERS

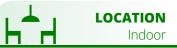
See at Activity 1: Introduction.

For interconnections see *Nine Principles of Biomimicry* module.



» QUESTION

ACTIVITY DETAILS



1 INTRODUCTION



projector, PC
<u>9_principles.ppt</u>; 3rd slide



Arrange classroom for presentation and discussion.



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

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.

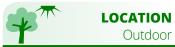
The cheetah can run very fast, but only for a short distance. If catching the prey means using more energy than it puts into running, it stops running.

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.



ACTIVITY DETAILS



TOOLS AND MATERIALS

2 SEARCHING FOR ENERGY FORMS

» DISCOVER 🕥

This activity provides students practice using analogical reasoning for bioinspired 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).

PREPARATIONS

Student worksheet: W2.1

• Teacher's page: <u>T2.1</u>

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

Cut <u>W2.1</u> into cards.



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





Arrange classroom for discussion.

(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

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

3| REVIEW

be found in T2.1.

» QUESTION

- 2
- 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)?



TEACHER'S PAGES

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	



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