MODULE V

Lesson Plan 3

Summary

Title	
Mini Wind Generator	
Duration	50 minutes
Age range	10-14

Abstract

This educational activity, aimed at students aged 10 to 14, seeks to understand how wind turbines work and raise awareness about the use of renewable energies.

During the session, students will participate in designing and constructing a functional model of a wind turbine. The activity will begin with a brief theoretical introduction to wind energy, its importance in the global energy matrix, and its environmental benefits.

Students will then work in teams to build their small-scale wind turbines using simple, recyclable materials. They will receive a basic kit with blades, a generator, and other necessary components. During the process, creativity and innovation in the blades' design and the wind turbine's structure will be encouraged.

Once the models have been built, the teams will test their wind turbines using a fan to simulate the wind. They will test how electricity is generated and analyse the factors that influence the efficiency of their designs.

To conclude, students will present their projects, sharing the challenges faced and solutions implemented. The impact of renewable energies on reducing the carbon footprint will be discussed, and possible improvements for future projects will be explored.

This activity will not only provide a practical understanding of the principles of wind energy. Still, it will develop teamwork, problem-solving, and critical thinking skills while fostering greater awareness of sustainability and the environment.

Learning results

Aim of the project / Learning objectives

- Raise awareness of the importance of sustainability through renewable energies for the care of the environment.
- To know the importance of recycling for the reduction of waste.
- To understand the operation of a wind generator (transformation of wind energy into electrical energy).

Transversal objectives

- Implementing environmental education.
- Stimulate creativity and innovation.
- Promote collective thinking in the search for solutions.

Sustainable Development Goals Connection

This topic is aligned with SDG 7 "Ensure access to affordable, secure, sustainable and modern energy" Goal 7.2 By 2030, significantly increase the share of renewable energy in the energy mix.

Implementation

Facilitation

- Prepare the resources for the activity in advance for its correct development.
- Ensure that all materials used are recyclable.
- Separate the classroom tables into groups in advance.
- With the tin, fix the LED wires to the back of the motor.

Resources / Materials needed

- 1 small plastic box.
- 6 bottle caps or bricks.
- 1 bottle cap or a larger brick.
- 1 DC motor.
- 1 small, narrow PVC pipe.
- 1 straw.
- 1 LED.
- Silicone gun and silicone tube.
- 1 box cutter.
- 1 scissors.
- Tin.
- Contact adhesive.
- 1 fan.

Ideas to continue

- Wind Turbine Design Optimisation: researching and implementing improvements in the design of wind turbine blades to increase their efficiency and power generation capacity.
- Environmental Impact Analysis: to carry out studies on the environmental impact of wind turbines in different environments, including effects on local fauna and landscape.
- Development of Sustainable Materials: researching and using more sustainable and recyclable materials to construct the models, promoting the circular economy.
- Simulation and Modelling: Use a simulation software to model the behaviour of the wind turbine under different wind and weather conditions, allowing students to experiment with different scenarios.

- Community Implementation Projects: develop projects where students can propose and implement small-scale wind turbines in their local communities, promoting environmental awareness and the use of renewable energy.

Source / Classroom materials and preparation

A detailed explanation of how to create the model:
https://www.youtube.com/watch?v=wcU857wj8ks&ab_channel=ProyectosCasero
Other similar projects:

- https://www.youtube.com/watch?v=gEpM_xAkaWM&ab_channel=ProyectosCasero
- https://es.slideshare.net/slideshow/proyecto-demedioambientegeneradoreolico-1/44926134
- https://redesteam.es/recursos/c%C3%B3mo-construir-un-generador-e%C3%B3lico-simple

Topic outline

Time	Step-by-step instructions
5 min.	Preparation of groups in the classroom
10 min.	Brief theoretical introduction to wind energy, its importance in the global energy matrix, and its environmental benefits. Explanation of the activity.
5 min.	With the silicone gun, the PVC pipe is glued onto the plastic box as the base of the wind turbine (see Annex 2 / Figure 5.3.1). The small plugs are then glued laterally to the side of the larger plug in the form of a helix (see Annex 2 / Figure 5.3.2).
5 min.	Make a hole in the centre of the large plug with the scissors (see Annex 2 / Picture 3) and insert the motor (see Annex 2 / Figure 5.3.4). Fix it with contact glue at the tip. Check that it rotates correctly.
5 min.	The back of the motor is glued to the top of the PVC pipe with the silicone (see Annex 2 / Figure 5.3.5). The straw is cut and glued with silicone on the plastic box right next to the PVC pipe (See Annex 2 / Figure 5.3.6). The LED light is then glued onto the straw with silicone (see Annex 2 / Figure 5.3.7).
10 min.	With the fan, give air to the mini generators and check that the LED lights up correctly in all of them (See Annex 2 / Figure 5.3.8).
10 min.	Discuss the impact of renewable energies on reducing the carbon footprint and explore possible improvements for future projects.

Formative evaluation
- Observe the interest and participation of each student in the classroom. - Ask questions orally to check group and individual learning. - Carry out digital questionnaires with the Kahoot platform.

Feedback

Net Promoter Score (NPS) is a widely used tool to measure the loyalty and satisfaction of customers or, in an educational context, students. It measures the likelihood that students will recommend the subject or course to others.
How to analyse and apply NPS is explained below:

Development of the NPS question:

- Main question: "On a scale of 0 to 10, how likely are you to recommend this topic to other students?
- Follow-up questions: "Why did you select this score?" and "How can we improve this issue?

Collection of responses:

- Digital surveys: Online tools such as Google Forms, SurveyMonkey, or Typeform can be used to collect student responses.
- Paper surveys: At the end of the lesson, paper questionnaires are distributed for students to complete. The Annex shows a template for collecting responses with paper surveys.
- Interactive applications: Interactive applications such as Quizziz, Mentimeter, or Kahoot! are used to collect real-time answers.

Classification of responses:

- Promoters (Score 9-10): Students are very satisfied and likely to recommend the subject.
- Passive (score 7-8): Satisfied but not enthusiastic students; they could easily change their minds.
- Detractors (Score 0-6): Dissatisfied students who are unlikely to recommend the subject; they could provide constructive criticism.

Calculation of NPS:

- Formula: NPS = % of promoters - % of detractors.
- Score interpretation: NPS ranges from -100 to +100. A positive score (above 0) is generally good, and a score above 50 is excellent.

Analysing and using comments:

- Review the comments to understand the reasons behind the scores.
- Identifies patterns and specific areas for improvement among detractors and passives.
- Use the promoters' positive comments to reinforce the positive aspects of the issue.

Annexes

ANNEX 1:

QUESTIONNAIRE TO COLLECT FEEDBACK ON THE TOPIC

On a scale of 0 to 10, how likely would you recommend this subject to other students?

0	1	2	3	4	5	6	7	8	9	10

Not likely at all — Extremely likely

Why did you choose that score?

How could this issue be improved?

ANNEX 2:

In this Annex, the Figures representing the development of the proposed activity are shown.



Figure 5.3.1 Gluing the PVC pipe onto the plastic box as the base of the wind turbine. Link: https://www.youtube.com/watch?v=wcU857wj8ks&ab_channel=ProyectosCasero

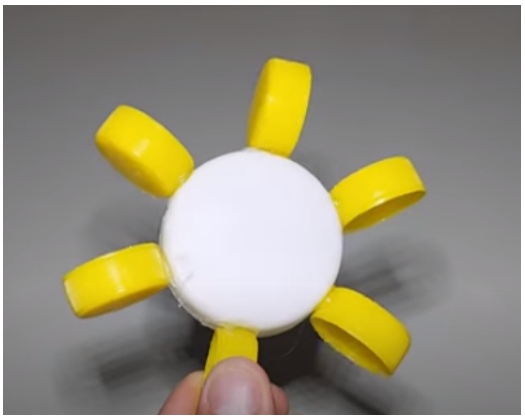


Figure 5.3.2 Gluing the small plugs to the side of the larger plug in the form of a helix. Link: https://www.youtube.com/watch?v=wcU857wj8ks&ab_channel=ProyectosCasero

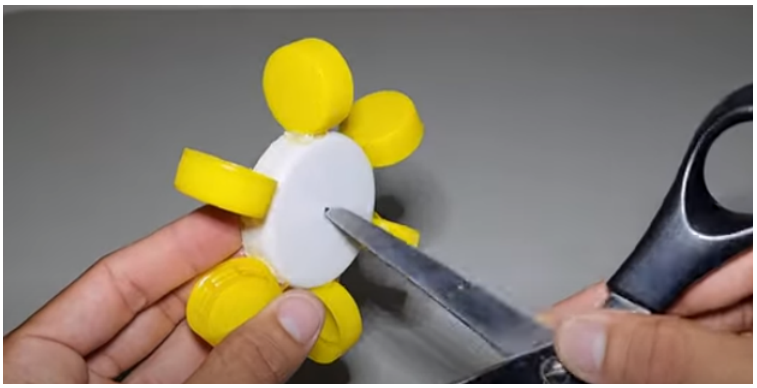


Figure 5.3.3 Making a hole in the centre of the large plug with the scissors. Link: https://www.youtube.com/watch?v=wcU857wj8ks&ab_channel=ProyectosCasero

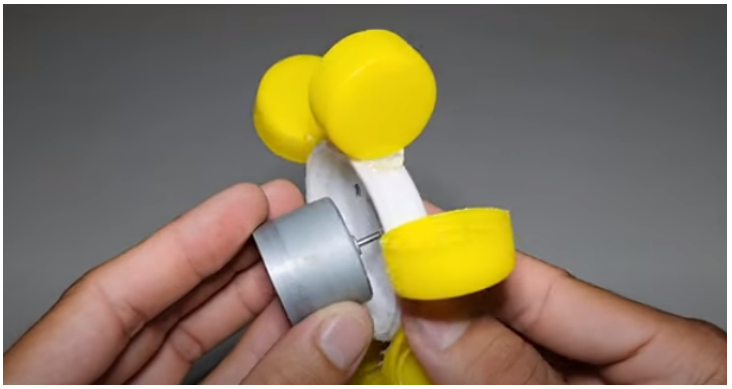


Figure 5.3.4 Motor insertion. Link:
https://www.youtube.com/watch?v=wcU857wj8ks&ab_channel=ProyectosCasero

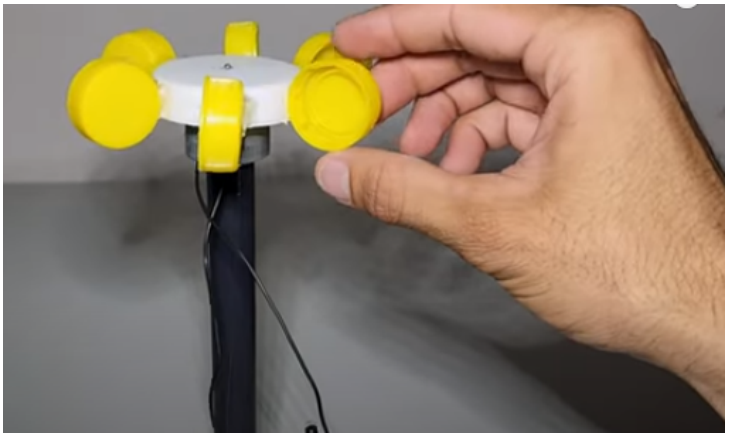


Figure 5.3.5 Gluing the back of the motor to the top of the PVC pipe with the silicone. Link:
https://www.youtube.com/watch?v=wcU857wj8ks&ab_channel=ProyectosCasero

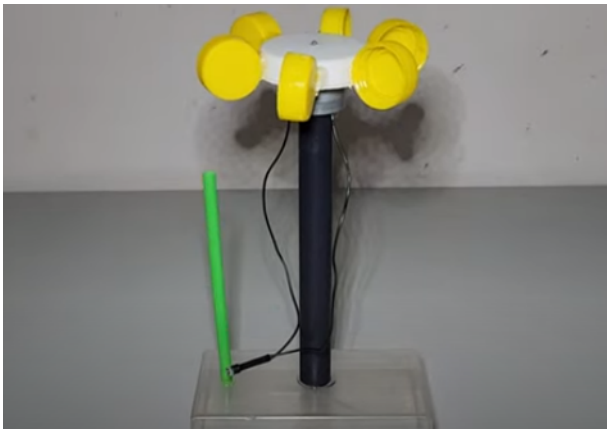


Figure 5.3.6 Gluing the straw on the plastic box with silicone. Link:
https://www.youtube.com/watch?v=wcU857wj8ks&ab_channel=ProyectosCasero



Figure 5.3.7 Gluing the LED light onto the straw with silicone. Link: https://www.youtube.com/watch?v=wcU857wj8ks&ab_channel=ProyectosCasero

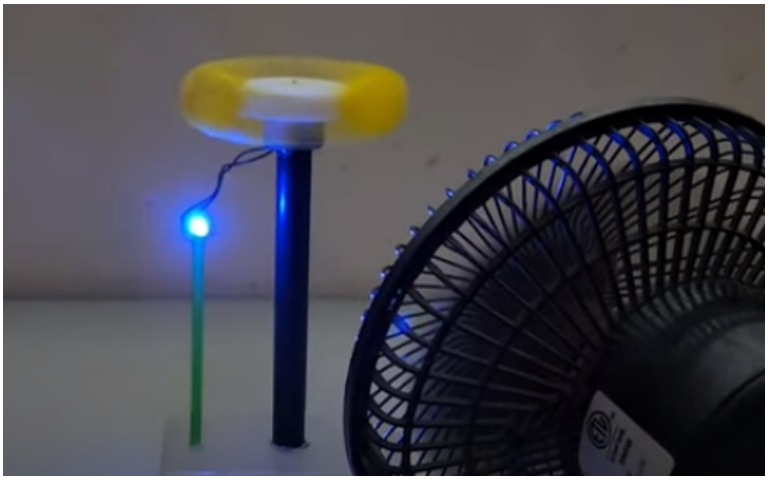


Figure 5.3.8 Turning on the fan and checking that the LED lights up correctly. Link: https://www.youtube.com/watch?v=wcU857wj8ks&ab_channel=ProyectosCasero